WSCG 2015

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ABSTRACTS

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Advanced Conference Program

Keynote speaker
Marina L. Gavrilova, University of Calgary, Canada

Conference Co-Chairs
Marina L. Gavrilova, University of Calgary, Canada
Vaclav Skala, University of West Bohemia, Plzen, Czech Republic

WSCG 2015

Advanced Conference Program

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- Yoshida,H., Nabata,K., Iwasaki,K., Dobashi,Y., Nishita,T.: Adaptive Importance Caching for Many-Light Rendering [Q31]
- Ehm,A., Ederer,A., Klein,A., Nischwitz,A.: Adaptive Depth Bias for Soft Shadows [S67]
- Myllykoski, M., Glowinski, R., Kärkkäinen T., Rossi T.: A GPU-Accelerated Augmented Lagrangian Based L1-mean Curvature Image Denoising Algorithm Implementation [Q11]

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- Boettcher,G.B., Freitas,C.D.S, Comba,J.: News Patterns: how press interacts with social networks [S61]
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- Campoalegre,L., Navazo,I., Brunet, P.: Hybrid ROI-Based Visualization of Medical Models [O67]
- Nysjö,J., Malmberg,F., Sintorn,I., Nyström,I.: BoneSplit - A 3D Texture Painting Tool For Interactive Bone Separation in CT Images [T17]
- Balreira,D.G., Maciel,A., Cavazzola, L.T., Walter,M.: Cuts in Organs with Internal Structures [O13]

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- Kovacs,V., Tevesz,G.: Edge-aware Normal Estimation by Rotated Bilateral Sampling [Q89]
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- Fatchurrahman,D., Makoto Kuramoto,M., Kondo,N., Ogawa,Y., Suzuki,T.: Identification of UV-Fluorescence Components Associated with and Detection of Surface Damage in Green Pepper (Capsicum annum L) [O05]
- Barina,D., Zemcik,P.: Real-Time 3-D Wavelet Lifting [O23]

- Damavandinejadmonfared,S.: A New Extension to Kernel Entropy Component Analysis for Image-based Authentication Systems [O29]
- Afrin,N., Lai.W.: Single Chord based Corner Detectors on Planar Curves [P17]
- Denisova,A., Myasnikov,V.: Anomaly Detection Using Spectral Mismatch Between Anomaly Pattern and its Neighborhood [P11]

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- Weier,M., Hinkenjann,A., Slusallek,P.: A Unified Triangle/Voxel Structure for GPUs and its Applications [R13]
- Odaker,T., Kranzlmueller,D., Volkert,J.: View-dependent Simplification using Parallel Half Edge Collapses [P31]
- Wasenmüller,O., Bleser,G., Stricker,D.: Joint Bilateral Mesh Denoising using Color Information and Local Anti-Shrinking [O71]

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- Frâncu, M., Moldoveanu, F.: Cloth Simulation Using Soft Constraints [O61]
- Anh-Cang,P., Romain,R., Marc,D.: An Adaptive Subdivision Scheme On Composite Subdivision Meshes [O97]

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- Boukhalfi,T., Desrosiers,C., Paquette,E.: A Machine Learning Approach to Automate Facial Expressions from Physical Activity [P47]
- Mukovskiy,A., Land,W.M., Schack,T., Giese,M.A.: Modeling of Predictive Human Movement Coordination Patterns for Applications in Computer Graphics [S89]
- Desprat,C., Luga,H., Jessel,J-P.: Hybrid client-server and P2P network for web-based collaborative 3D design [T19]
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- Jribi,M., Ghorbel,F.: A Geodesic Based Approach for an Accurate and Invariant 3D Surfaces Representation [S73]

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- Hast,A., Sablina,V., Kylberg,G., Sintorn, I-M.: A Simple and Efficient Feature Descriptor for Fast Matching [Q59]
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- Yang,B.X.,Yuan,M.,Ma,Y.D.,Zhang,J.W.: Magnetic Resonance Images Reconstruction using Uniform Discrete Curvelet Transform Sparse Prior based Compressed Sensing [R29]

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- Lakshmiprabha,N. S., Santos,A., Beltramello,O.: An Efficient Reduction of IMU Drift for Registration Error Free Augmented Reality Maintenance Application [S43]
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- Ahmed,F., Paul,P.P., Gavrilova,M.: Kinect-Based Gait Recognition Using Sequences of the Most Relevant Joint Relative Angles [S97]
- da Graça,F., Paljic,A.,Diaz,E.: Evaluating Stereoscopic Visualization for Predictive Rendering. [Q29]
- Park,K.Y., Kim,D.S.: A Weight Adjustment Strategy to Prevent Cascade of Boosted Classifiers from Overfitting [R73]

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- Fujimoto,K., Watanabe,T.: 3D Reconstruction of Outdoor Scenes Using Structure from Motion and Depth Data [P73]
- Meier,B., Trapp,M., Döllner,J.: VideoMR: A Map and Reduce Framework for Real-time Video Processing [S31]
- Baum,D.: Introducing Aesthetics to Software Visualization [Q03]
- Golçalves,D.A., Todt,E., García,L.S.: 3D Avatar for Automatic Synthesis of Signs for The Sign Languages [O73]

- Talbi,F., Alim,F., Seddiki,S., Mezzah,I., Hachemi,B.: Separable Convolution Gaussian Smoothing Filters on a Xilinx FPGA platform [S19]

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- Sultana,M., Paul,P.P., Gavrilova,M.: Occlusion Detection and Index-based Ear Recognition [R97]
- Goncalves,J., Ribeiro,D., Soares,F.,: Perspective Correction of Panoramic Images created by Parallel Motion Stitching [S59]
- Kim,D.S., Park,K.Y.: Pose-Specific Pedestrian Classification using Multiple Features in Far-Infrared Images [R41]
- Oliveira,I.O., Fonseca,K.V.O., Todt,E.: IGFTT: towards an efficient alternative to SIFT and SURF [P41]
- Dave,J., Venkatesh,K.S., Jain,G.: Online 3D Signature Verification by using Stereo Camera & Tablet [T31]

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- Sigut,J., Fumero,F., Nunez,O.: Over- and Under-Segmentation Evaluation based on the Segmentation Covering Measure [Q61]
- Merz,J., Getto,R., von Landesberger,T.: Analysis of 3D Mesh Correspondences Concerning Foldovers [T11]
- Chen,Y.-N., Wang,Y.-Ch., Han,Ch-Ch., Fan,K-Ch.: Hyperspectral Image Classification Using a General NFLE Transformation with Kernelization and Fuzzification [Q43]
- Kuznetsov,A., Myasnikov,V.: New algorithms for satellite data verification with and without the use of the imaged area vector data [N97]
- Kurmi, V.K., Jain, G., Venkatesh, K.S.: Robust Human Gesture Recognition from 3D Data [T23]

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- Chembaev,V.D, Zheltov,V.S., Budak,V.P., Notfulin,R.S: Local Monte Carlo estimation methods in the solution of global illumination equation [R79]
- Marek,J., Rak,J. Jetensky,P.: Statistical solution of 3D transformation problem [S53]
- Volkov,V., Yurkov,V., Chizhik,M., Moskovtsev,M.: Symbolic-graphic design of Pk x Pm Segre varieties in the Pn space [O17]
- Gordeev,D.: Reasoning about Graph Algorithm Visualization [S02]
- Thomsen,K., Kraus,M.: Simulating Small-Scale Object Stacking Using Stack Stability [O53]
- Benziane,S., Benyettou,A.: Hand vein authentication based wavelet feature extraction [O03]
- Ganguly,S., Bhattacharjee,D., Nasipuri,M.: Efficient Representation of Range Face Images Using Vectorfaces [P07]
- Novotortsev,L., Voloboy,A.: Automated Detection of Buildings on Aero Images [P29]
- Kim,E.S., Choi,S.I., Park,S.Y.: A new 6D ICP algorithm with color segmentation-based adaptive sampling [P67]
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- Mitaritonna A., Abásolo, M.: Improving Situational Awareness in Military Operations using Augmented Reality [Q83]
- Kopenkov,V., Myasnikov,V.: Detection and tracking of vehicles based on the videoregistration information [R03]
- Choi,J., Kim,Y., Choe,Y.: A Novel Retinex Model Based on Sparse Source Separation [R37]

- Bilinskas,M.J., Dzemyda,G., Trakymas,M.: Computed Tomography Image Analysis: the Model of Ribs-Bounded Contour [S17]
- Castro,G., Oliveira,P.: Computer Vision Framework for Object Detection: FrODet [S29]
- Perechesova,A.D., Soloveva,G.A., Kalapyshina,I.I.: Hough Transform for the Calculation of Twist Angle of Aramid Torsion [S79]
- Jaszuk,M., Szostek,G., Starzyk,J.A.: Building 3D Object Representation Using SURF Local Features [T02]
- Bhatia,S., Kar,A., Gupta,G.: Image Segmentation Using Similarity Filtering Based Multilevel Thresholding [T29]

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- Maher,J., Mohamed,J.: Robust Hand Segmentation and Tracking During Occlusion in Sign Language [O83]
- Elbahi,A., Omri,M.N.: Conditional Random Fields For Web User Task Recognition Based On Human Computer Interaction [Q97]
- Petrova,Y.: Virtual Museum as an Environment for Visual Representation of Urban Planning Concepts and Lost Architectural Objects [Q47]
- Chadimova,L.: The creation of serious games intended for historically oriented subjects at the 1st level of [Q53]
- Gashnikov,M., Glumov,N.: Hyperspectral images repository using a hierarchical compression [O37]
- Taertulakarn,S., Tosranon,P., Pintavirooj,C.: Using Intrinsic Surface Geometry Invariant for 3D Ear Alignment [P37]
- Maas,S., Overhoff,H.M.: A COM-based Toolkit for Real Time Volume Visualization [Q02]
- Zhi,J.: An alternative green screen keying method for film visual effects [Q37]
- Priyadarshi,S., Jain,P.K., Roy,J.J., Samal,M.K., Tandon,P.,: Feature based assessment of forming force behavior in Incremental Sheet Forming [S83]

KEYNOTE

T61: Data Mining and Data Analytics in Biometric Security

Gavrilova,M.

Abstract:

The security research domain has recently witnessed tremendous growth with respect to all aspects of information access and sharing. There has been notable progress in developing successful approaches to tackle the problem of user authentication. Among those approaches, biometric-based authentication has firmly established itself as one of the most reliable, efficient, and versatile tools for providing discretionary access control to a secure resource or system. While state-of-the art methods for biometric authentication are becoming increasingly more powerful and better understood, the same, unfortunately, cannot be said about security of users populating on-line communities or cyberworld.

Ensuring safe and secure communication and interaction among users and their on-line identities presents unique challenges to academia as well as industry, government, and the public. Despite the fact that those challenges are regularly making headlines in the news, in government reports and in the IT security domain, there is a lack of effort to address this urgent problem. The limited efforts that do exist are currently restricted to network security, password protection, encryption, database security and policy-making efforts. However, one of the most crucial components for ensuring biometric and on-line security: the relationship between communication among users and user authentication, has been largely overlooked. This crucial issue requires a systematic study and a targeted effort to develop effective machine intelligence security solutions for cyberworlds.

FULL Papers

O05: Identification of UV-Fluorescence Components Associated with and Detection of Surface Damage in Green Pepper (Capsicum annum L)

Fatchurrahman,D., Makoto Kuramoto,M., Kondo,N., Ogawa,Y., Suzuki,T.

Abstract:

Fluorescence imaging has been used to detect fruit surface damage, but has not yet been applied to vegetables, such as green pepper. In this report, we extract and identify fluorescent components from the exocarp (skin) of green pepper. The fluorescence excitation and emission wavelengths of these extracted compounds were determined using a fluorescence spectrophotometer and identified using nuclear magnetic resonance spectroscopy and mass spectrometry. Red and blue florescent components with excitation and emission wavelengths 667 - 685 and 400 - 438 nm respectively, were found. In subsequent research, the red fluorescent compounds were targeted, as these compounds have a higher fluorescence intensity, around 97 a.u. Pheophytin a was one of these red fluorescent compounds, appearing in the mass spectrum at 871 m/z. Furthermore, when a fluorescence imaging system was set up, with halogen illumination, it was shown that this system could detect surface damage in green pepper.

O13: Cuts in Organs with Internal Structures

Balreira,D.G., Maciel,A., Cavazzola, L.T., Walter,M.

Abstract:

Current simulations in virtual surgery use three-dimensional representations of organs without any internal structure. For some applications, however, there is a need to represent also the organs internal anatomical structures, such as blood vessels. We present, in this paper, a technique that allows arbitrarily oriented cuts through objects, particularly anatomical structures, reconstructing the mesh surface in the cutting zone. In the process, all internal structures participate in the final rendering of the generated surface. As a case study, we selected a human liver model with vessels and present the internal visualization of the liver in real time for arbitrary cutting planes. Our work has applications, for instance, in improving current state-of-the-art surgery simulators for training of students and medical doctors. Simulations present many advantages over other training since they reduce time and cost spent by

professionals, offering less risk to the patients. Besides, studies show that the amount of realism seen in the simulators is positively correlated to the engaging of students in learning.

O23: Real-Time 3-D Wavelet Lifting
Barina,D., Zemcik,P.
Abstract:
This work presents a fast streaming unit for computing a 3-D discrete wavelet transform. The unit can continuously consume source data and instantly produce resulting coefficients. Considering this approach, every input as well as output sample is visited only once. The streaming unit can be further improved by exploiting suitable SIMD instruction set. Depending on the platform, the proposed method reaches speedup 11x and 8x compared to the naive implementation. The measurements presented in the paper confirm the linear theoretical complexity of the transform. Our method requires a constant amount of time to transform a sample independently of the data size.

O29: A New Extension to Kernel Entropy Component Analysis for Image-based Authentication Systems
Damavandinejadmonfared,S.
Abstract:
We introduce Feature Dependent Kernel Entropy Component Analysis (FDKECA) as a new extension to Kernel Entropy Component Analysis (KECA) for data transformation and dimensionality reduction in Image-based recognition systems such as face and finger vein recognition. FDKECA reveals structure related to a new mapping space, where the most optimized feature vectors are obtained and used for feature extraction and dimensionality reduction. Indeed, the proposed method uses a new space, which is feature wisely dependent and related to the input data space, to obtain significant PCA axes. We show that FDKECA produces strikingly different transformed data sets compared to KECA and PCA. Furthermore a new spectral clustering algorithm utilizing FDKECA is developed which has positive results compared to the previously used ones. More precisely, FDKECA clustering algorithm has both more time efficiency and higher accuracy rate than previously used methods. Finally, we compared our method with three well-known data transformation methods, namely Principal Component Analysis (PCA), Kernel Principal Component Analysis (KPCA), and Kernel Entropy Component Analysis (KECA) confirming that it outperforms all these direct competitors and as a result, it is revealed that FDKECA can be considered a useful alternative for PCA-based recognition algorithms

O61: Cloth Simulation Using Soft Constraints
Frâncu, M., Moldoveanu, F.
Abstract:
This paper describes a new way of using projective methods for simulating the constrained dynamics of deformable surfaces. We show that the often used implicit integration method for discretized elastic systems is equivalent to the projection of regularized constraints. We use this knowledge to derive a Nonlinear Conjugate Gradient implicit solver and a new projection scheme based on energy preserving integration. We also show a novel way of adding damping to position based dynamics and a different view on iterative solvers. In the end we apply these fresh insights to cloth simulation and develop a constraint based finite element method capable of accurately modeling thin elastic materials.

O67: Hybrid ROI-Based Visualization of Medical Models
Campoalegre,L., Navazo,I., Brunet, P.
Abstract:
There is an increasing interest on tele-medicine and tele-diagnostic solutions based on the remote inspection of volume data coming from multimodal imaging. Handling three-dimensional information during the remote visualizations of medical images requires efficient systems to achieve fast data transmission and interactive visualization of high quality images. Client-server architectures meet these functionalities. The use of mobile devices is sometimes required due to the portability and easy maintenance. However, transmission time for the volumetric information and low performance hardware properties, make quite complex the design of efficient visualization systems on these devices. In this paper we present a hybrid approach which is based on regions of interest (ROIs) and on a transfer-function aware compression scheme. It has a good performance in terms of bandwidth requirements and storage needs in the client device, being flexible enough to represent several materials and volume structures in the ROI. Clients store a low-resolution version of the volume data and ROI-dependent high resolution segmented information. Data must be only sent anytime a new ROI is requested, but interaction in the client is autonomous without any data transmission while a certain ROI is inspected. A benchmark is presented to compare the the proposed scheme with three existing approaches, on two different volume data models. The results show that our hybrid approach is compact, efficient and scalable, with compression rates that decrease when the size of the volume model increases.

O71: Joint Bilateral Mesh Denoising using Color Information and Local Anti-Shrinking

Wasenmüller,O., Bleser,G., Stricker,D.

Abstract:

Recent 3D reconstruction algorithms are able to generate colored meshes with high resolution details of given objects. However, due to several reasons the reconstructions still contain some noise. In this paper we propose the new Joint Bilateral Mesh Denoising (JBMD), which is an anisotropic filter for highly precise and smooth mesh denoising. Compared to state of the art algorithms it uses color information as an additional constraint for denoising; following the observation that geometry and color changes often coincide. We face the well-known mesh shrinking problem by a new local anti-shrinking, leading to precise edge preservation. In addition we use an increasing smoothing sensitivity for higher numbers of iterations. We show in our evaluation with three different categories of testdata that our contributions lead to high precision results, which outperform competing algorithms. Furthermore, our JBMD algorithm converges on a minimal error level for higher numbers of iterations.

O79: Improvement of a Topological-Physical Model to manage different Physical Simulations

Golec,K., Coquet,M., Zara,F., Damiand,G.

Abstract:

In this paper, we present an improvement of a unified topological-physical model, which makes it more generic, efficient and simpler to update. The main principle of our improvement is to associate information to elements of the model, depending on the underlying physical model. This solution is more generic since it is enough to modify the elements to implement a new physical model. Moreover, topological operations and physical simulations can be factorized between the different physical models. Our solution leads to simpler modification algorithms after topological alterations, since there are less changes to apply. Thanks to these simplifications, our solution is more efficient. In this paper, firstly we present our new solution. Secondly, we illustrate the new properties of our solution by showing some results of experiments made on a mass-spring system and a mass tensor model. A comparison in time of the cutting operation with the previous solution was in particular performed. Lastly, we introduce a preliminary simulation to reproduce soft bodies experiments.

O97: An Adaptive Subdivision Scheme On Composite Subdivision Meshes

Anh-Cang,P., Romain,R., Marc,D.

Abstract:

One of the commonly used techniques in hole filling and mesh joining is the construction of connecting meshes between meshes to generate a new mesh model consisting of the composite subdivision meshes. One problem in subdivision meshes is how to further subdivide this reconstructed mesh model or these composite subdivision meshes to enhance the quality of the surface as needed. In this paper, we propose a new local subdivision method of the composite subdivision meshes. Our method does not alter the surrounding mesh areas, and guarantees that the discrete continuity between these meshes is preserved without the occurrence of cracks or holes between them. We specifically address a local subdivision scheme on a connecting mesh (the mesh area covering hole or crack) suitable for refining only the connecting mesh or the selected mesh areas. Our method can produce a smooth mesh model with a natural shape, and allows approximation or interpolation of surfaces. We implement our method for various triangular meshes and present our experimental results.

P41: IGFTT: towards an efficient alternative to SIFT and SURF

Oliveira,I.O., Fonseca,K.V.O., Todt,E.

Abstract:

The invariant feature detectors are essential components in many computer vision applications, such as tracking, simultaneous localization and mapping (SLAM), image search, machine vision, object recognition, 3D reconstruction from multiple images, augmented reality, stereo vision, and others. However, it is very challenging to detect high quality features while maintaining a low computational cost. Scale-Invariant Feature Transform (SIFT) and Speeded-Up Robust Features (SURF) algorithms exhibit great performance under a variety of image transformations, however these methods rely on costly keypoint's detection. Recently, fast and efficient variants such as Binary Robust Invariant Scalable Keypoints (BRISK) and Oriented Fast and Rotated BRIEF (ORB) were developed to offset the computational burden of these traditional detectors. In this paper, we propose to improve the Good Features to Track (GFTT) detector, coined IGFTT. It approximates or even outperforms the state-of-art detectors with respect to repeatability, distinctiveness, and robustness, yet can be computed much faster than Maximally Stable Extremal Regions (MSER), SIFT, BRISK, KAZE, Accelerated KAZE (AKAZE) and SURF. This is achieved by using the search of maximal-minimum eigenvalue in the image on scale-space and a new orientation extraction method based on eigenvectors. A comprehensive evaluation on standard datasets shows that IGFTT achieves quite a high performance with a computation time comparable to state-of-the-art real-time features. The

proposed method shows exceptionally good performance compared to SURF, ORB, GFTT, MSER, Star, SIFT, KAZE, AKAZE and BRISK.

P17: Single Chord based Corner Detectors on Planar Curves

Afrin,N., Lai.W.

Abstract:

Detecting corner locations in the images plays a significant role in several computer vision applications as corner contains important information of an image. In this paper we have analyzed an existing state of art, CPDA (Chord to Point Distance Accumulation) corner detector and modified this detector in way that it uses a single chord instead of using three different chords. We have also proposed a simple but effective new method of detecting robust corner locations against different image transformations using cumulative distance calculation. The new method has also a single chord and named as CCSR (Chord to Cumulative Sum Ratio). A comprehensive performance evaluation has been performed by using Average Repeatability and Localization Error. We have found that the single chord CPDA detector and the CCSR detector perform better than the original CPDA detector. Our experiment results show that the CCSR using simple cumulative calculation outperforms eight other existing contour based corner detectors in terms of repeatability and generates one of the lowest localization errors. In addition, the CCSR detector is also most efficient corner detector among other contour-based corner detectors.

P23: GeoPeeling Lens: Deformation-Based Technique for Exploratory Data Analysis

Debiasi,A., Simoes,B., De Amicis,R.

Abstract:

Spatial datasets describing relations between geographical entities are typically visualized as a node-link diagram depicted over a geographical layout. This visual representation is well-suitable to perform tasks based on the topology of the graph and on the properties of the depicted elements. The readability of the node-links is one of the main issue studied in literature. In this paper we describe an interactive technique for virtual globe layouts, called GeoPeeling, that reveals spatial information that otherwise would be hidden behind the geographical layout, by applying spatial deformations. The main advantage of our approach is that it facilitates graph-related tasks by reducing the overall number of actions required to visualize speci'c spatial relations. Moreover, it does not require additional user procedures and can be easily combined with other techniques like focus+context, which act on the node-links. Our approach is evaluated with an analysis of the graphical performance together with an informal user study.

P31: View-dependent Simplification using Parallel Half Edge Collapses

Odaker,T., Kranzlmueller,D., Volkert,J.

Abstract:

Highly detailed models have become a requirement for many applications in modern computer graphics. The necessary level of detail, however, may vary depending on the application. To provide a tradeoff, mesh simplification is used to generate approximations of a model which can be used to reduce processing time. We present a parallel approach to triangle mesh simplification that is designed to allow fast, view-dependent simplification of manifold triangle meshes. Our approach performs a vertex analysis on every vertex of a given triangle mesh and selects a set of vertices for removal. Vertex removal is executed using the parallel half edge collapse. Based on the half edge collapse, that replaces an edge with one of its endpoints, we have devised a set of boundaries that enable parallel application of half edge collapses even on neighbouring vertices. Since the mesh topology may not allow removal of all vertices marked for removal in one step, we apply multiple iterations of the parallel half edge collapse, reevaluating remaining vertices marked for removal for further improvement of results.

P47: A Machine Learning Approach to Automate Facial Expressions from Physical Activity

Boukhalfi,T., Desrosiers,C., Paquette,E.

Abstract:

Facial expressions are complex to model since they involve various factors, mainly psychological, biomechanical and sensory. While facial performance capture provides good facial expressions, it is costly and difficult to use for real-time interaction. A number of tools and techniques exist to automate facial animation related to speech or emotion, but there are no tools available to automate the facial expression related to physical activity. This leads to unrealistic characters, especially when a 3D character performs intense physical activity. The purpose of this research is to highlight the link between physical activity and facial expression, and propose a data-driven approach providing realistic facial expressions, while leaving creative control. First, motion capture was used to gather biological, mechanical and facial expression data. This information was then used to train regression trees and support vector machine models, which can later predict the facial expressions of virtual characters from their 3D motion. The proposed approach can be used with real-time, pre-recorded or

key-framed animations, making it suitable for video games and movies as well.

P71: Image-based Object Modeling by Fitting Salient Lines and Geometric Primitives

Cho,M.-H., Lin,I.-C.

Abstract:

With modern vision techniques and depth sensing devices, it becomes possible for common users to acquire the shape of an object from a set of color or depth images from different views. However, the estimated 3D volume or point clouds, disturbed by noise and errors, cannot directly be applied for graphics usage. This paper presents a two-stage method for reconstructing 3D graphics models from point clouds and photographs. Unlike related work that immediately fitted primitives for the point clouds, we propose finding the primary planes through salient lines in images in advance, and extracting auxiliary planes according to the symmetric properties. Then, a RANSAC method is used to fit primitives for the residual points. Intuitive editing tools are also provided for rapid model refinement. The experiments demonstrate that the proposed automatic stages can generate more accurate results. Besides, the user intervention time is less than that by a well known modeling tool.

P79: An Improved Non-Orthogonal Texture Warping for Better Shadow Rendering

Milet,T., Navrátil,J., Zemčík,P.

Abstract:

In interactive applications, shadows are traditionally rendered using the shadow mapping algorithm. The disadvan-tage of the algorithm is limited resolution of depth texture which may lead to aliasing artifacts on shadow edges. This paper introduces an improved depth texture warping with non-orthogonal grid that can be employed for all kinds of light sources. For instance, already known approaches for reducing aliasing artifacts are widely used in outdoor scenes with a directional light source but they are not directly applicable for point light sources. We show that an improved warping parameterization reduces the aliasing artifacts and we are able to present high quality shadows regardless of a light source or a camera position in the scene.

P83: Using Mutual Independence of Slow Features for Increased Information and Improved Hand Pose Classification

Tewari,A., Taetz,B., Stricker,D, Grandidier,F.

Abstract:

We propose a Slow Feature Analysis (SFA) based classification of Hand Poses and demonstrate that the property of mutual independence of the slow feature functions can be exploited to improve the classification performance of SFA. SFA involves the identification of functions that describe trends in a time series data. SFA is capable of isolating noise from information while it conserves high-frequency components of the data which are consistently present over time or in the set of data points. SFA is a useful knowledge extraction method, it is modified to learn from data such that the identified functions are better suited for distinguishing classes. We show an improvement in classification quality by using the property of orthogonality in SFA, therefore mutually independent slow features are learnt from within a class. This adaptation increases our information about classes, and will be demonstrated by better classification results on MNIST dataset as compared to the original method. Furthermore, We use a hand pose dataset with five possible classes to show the performance of SFA. It consistently achieves a detection rate of over 96% for each class. We compare the classification results with shape descriptive physical features, the PCA and the non-linear dimensionality reduction (NLDR) for manifold learning. We prove that a simple variance based decision algorithm for SFA works better than K Nearest Neighbour (KNN) on physical features, PCA and non-linear low dimensional representation. Finally, we examine Convolutional Neural Networks (CNN) in relation with SFA.

Q07: Evaluation of Space Partitioning Data Structures for Nonlinear Mapping

Myasnikov,E.V.

Abstract:

Nonlinear mapping (Sammon mapping) is a nonlinear dimensionality reduction technique operating on the data structure preserving principle. Several possible space partitioning data structures (vp-trees, kd-trees and cluster trees) are applied in the paper to improve the efficiency of the nonlinear mapping algorithm. At the first step specified structures partition the input multidimensional space, at the second step space partitioning structure is used to build up the list of reference nodes used to approximate calculations. The further steps perform initialization and iterative refinement of the low-dimensional coordinates of objects in the output space using created lists of reference nodes. Analyzed space partitioning data structures are evaluated in terms of the data mapping error and runtime. The experiments are carried out on the well-known datasets.

Q11: A GPU-Accelerated Augmented Lagrangian Based L1-mean Curvature Image Denoising Algorithm Implementation

Myllykoski, M., Glowinski, R., Kärkkäinen T., Rossi T.

Abstract:

This paper presents a graphics processing unit (GPU) implementation of a recently published augmented Lagrangian based L1-mean curvature image denoising algorithm. The algorithm uses a particular alternating direction method of multipliers to reduce the related saddle-point problem to an iterative sequence of four simpler minimization problems. Two of these subproblems do not contain the derivatives of the unknown variables and can therefore be solved point-wise without inter-process communication. In particular, this facilitates the efficient solution of the subproblem that deals with the non-convex term in the original objective function by modern GPUs. The two remaining subproblems are solved using the conjugate gradient method and a partial solution variant of the cyclic reduction method, both of which can be implemented relatively efficiently on GPUs. The numerical results indicate up to 33-fold speedups when compared against a single-threaded CPU implementation. The pointwise treated subproblem that takes care of the non-convex term in the original objective function was solved up to 76 times faster.

Q17: Simultaneous Absorption and Environment Light Reconstruction in Optical Tomography

Afanasyev,V., Ignatenko,A., Voloboy,A.

Abstract:

Classic tomography algorithms applied in optical tomography require the light source pre-calibration and do not allow refining the light map in tomography algorithm. This article shows an approach to environment light reconstruction during the ART algorithm execution. It makes the optical tomography scanning process more fast and simple, allowing to exclude the light calibration stage.

Q19: Localized search for high definition video completion

Benoit,J., Paquette,E.

Abstract:

This paper presents a new approach for video completion of high-resolution video sequences. Current state-of-the-art exemplar-based methods that use non-parametric patch sampling work well and provide good results for low-resolution video sequences. Unfortunately, because of memory consumption problems and long computation times, these methods handle only relatively low-resolution video sequences. This paper presents a video completion method that can handle much higher resolutions than previous ones. First, to address the problem of long computation times, a dual inpainting-sampling filling-order completion method is proposed. The quality of our results is then significantly improved by a second innovation introducing a coherence-based matches refinement that conducts intelligent and localized searches without relying on approximate searches or compressed data. Finally, with respect to the computation times and memory problems that prevent high-resolution video completion, the third innovation is a new localized search completion approach, which also uses uncompressed data and an exact search. Combined together, these three innovations make it possible to complete high-resolution video sequences, thus leading to a significant increase in resolution as compared to previous works.

Q29: Evaluating Stereoscopic Visualization for Predictive Rendering.

da Graça,F., Paljic,A.,Diaz,E.

Abstract:

The context of this work is predictive rendering, our objective is to previsualize materials based on physical models within computer graphics simulations. In this work we focus on paints constituted of metallic flakes within a dielectric binder. We want to validate a "virtual material workshop" approach, where a user could change the composition and the microstructure of a virtual material, visualize its predicted appearance, and be able to compare it to an actual sample. To do so, our methodology is to start from Scanning Electron Microscopy (SEM) imaging measures on an actual sample that allowed us to characterize two metrics: flake size and flake density. A statistical model based on those measures was then integrated in our spectral rendering engine using raytracing and photon mapping, with an off axis-frustum method to generate stereoscopic images for binocular visualization. Our objective is twofold: 1) perceptually validate our physical model, we evaluate if the virtual metric perceptually corresponds to the real metric of the real samples; 2) evaluate the contribution of virtual reality techniques in the visualization of materials. To do so, we designed a user study comparing photographs of car paint samples and their virtual counterpart based on a design of experiments. The observers evaluated the visual correspondence of different virtual materials generated from microstructures with varying metric values. The results show a perceptual correspondence between real and virtual metrics. This result has a strong impact: it means that for a desired appearance the proposed models correctly predict the microstructure. The second result is that stereoscopy

improves the metric correspondence, and the overall appearance score.

Q31: Adaptive Importance Caching for Many-Light Rendering
Yoshida,H., Nabata,K., Iwasaki,K., Dobashi,Y., Nishita,T.
Abstract:
Importance sampling of virtual point lights (VPLs) is an efficient method to compute the global illumination. The key to importance sampling is to construct the probability function, which is used to sample VPLs, proportional to the distribution of contributions from all VPLs. Importance caching records the contributions of all VPLs at sparsely distributed cache points and the probability function is calculated by interpolating cached data. Importance caching, however, distributes cache points randomly, which makes it difficult to obtain probability functions proportional to the contributions of VPLs where the variations of VPL contributions at nearby cache points are large. This paper proposes an adaptive cache insertion method for VPL sampling. Our method exploits the spatial and directional correlations of shading points and surface normals to enhance the proportionality. Then our method detects cache points with large variations of VPL contributions and inserts additional cache points with a small overhead. We demonstrate that our method can render less noise images compared to the importance caching in the equal-time rendering.

Q59: A Simple and Efficient Feature Descriptor for Fast Matching
Hast,A., Sablina,V., Kylberg,G., Sintorn, I-M.
Abstract:
A very simple but efficient feature descriptor is proposed for image matching/registration applications where invariance is not important. The descriptor length is only three times the height of the local region in which the descriptor is calculated, and experiments were conducted to compare it to the SURF descriptor. In addition, it is shown, how the sampling can be modified in order to obtain a rotation invariant descriptor, while still keeping it simple and efficient. Examples from stitching in microscopy and stereo pair extraction for stereo camera multicopters is given to prove the concept.

Q79: Isosurface Orientation Estimation in Sparse Grids Using Tetrahedral Splines
Wood,B., Newman,T.
Abstract:
ne challenge in applying marching isosurfacing methods to sparse rectilinear grid data is addressed. This challenge, the problem of finding approximating gradients adjacent to locations with data dropouts, is addressed here by a new approach that utilizes a tetrahedral spline fitting-based strategy for gradient approximation. The new approach offers improved robustness in certain scenarios (compared to the current state-of-the-art normal approximation approach for sparse grids). Comparative studies of the new approach's accuracy and computational performance are also presented.

R02: Heterogeneous Dataset Acquisition for a Continuously Expandable Benchmark (CEB)
Krolla,B., Stricker,D.
Abstract:
Ongoing research within the field of computer vision yielded a wide range of image based 3D reconstruction approaches. Starting years ago with low resolution RGB images as input, we face today a wide and fast growing range of available imaging sensors to perform this task. Many different benchmarks and datasets have been made available to allow for a good comparibility of resulting reconstructions. At the same time, we observe, that these benchmarks commonly address only a single capturing approach omitting the chance to compare against results of other acquisition methods. In contrast to such homogeneous benchmarks, we aim to provide in this work a heterogeneous benchmark, considering a range of different acquisition devices to acquire our datasets. Besides the resulting datasets from different capturing devices, we furthermore provide reference data from different sources for download. To lastly keep track of the rapidly increasing number of different acquisition sensors, we opt to provide occasional updates of the benchmark within the future.

R05: Explorative Analysis of 2D Color Maps
Steiger,M., Bernard,J., Mittelstaedt,S., Thum,S., Hutter,M., Keim D., Kohlhammer,J.
Abstract:
Color is one of the most important visual variables in information visualization. In many cases, two-dimensional information can be color-coded based on a 2D color map. A variety of color maps as well as a number of quality criteria for the use of color have been presented. The choice of the best color map depends on the analytical task users intend to perform and the design space in choosing an appropriate 2D color map is large. In this paper, we present the ColorMap-Explorer, a visual-interactive system that helps users in selecting the most appropriate 2D color map for their particular use case. ColorMap-Explorer also provides a library of many color map implementations that have been proposed in the scientific literature. To analyze their usefulness for different tasks, ColorMap-Explorer provides use case

scenarios to allow users to obtain qualitative feedback. In addition, quantitative metrics are provided on a global (i.e. per color map) and local (i.e. per point) scale. ColorMap-Explorer enables users to explore the strengths and weaknesses of existing as well as user-provided color maps to find the best fit for their task. Any color map can be exported to be reused in other visualization tools. The code will be published as open source software, so that the visualization community can use both the color map library and the ColorMap-Explorer tool. This also allows users to contribute new implementations.

R13: A Unified Triangle/Voxel Structure for GPUs and its Applications

Weier,M., Hinkenjann,A., Slusallek,P.

Abstract:

We present a system that combines voxel and polygonal representations into a single octree acceleration structure that can be used for ray tracing. Voxels are well-suited to create good level-of-detail for high-frequency models where polygonal simplifications usually fail due to the complex structure of the model. However, polygonal descriptions provide the higher visual fidelity. In addition, voxel representations often oversample the geometric domain especially for large triangles, whereas a few polygons can be tested for intersection more quickly. We show how to combine the advantages of both into a unified acceleration structure allowing for blending be- tween the different representations. A combination of both representations results in an acceleration structure that compares well in performance in construction and traversal to current state-of-the art acceleration structures. The voxelization and octree construction are performed entirely on the GPU. Since a single or two non-isolated tri- angles do not generate severe aliasing in the geometric domain when they are projected to a single pixel, we can stop constructing the octree early for nodes that contain a maximum of two triangles, further saving construction time and storage. In addition, intersecting two triangles is cheaper than traversing the octree deeper. We present three different use-cases for our acceleration structure, from LoD for complex models to a view-direction based approach in front of a large display wall.

R29: Magnetic Resonance Images Reconstruction using Uniform Discrete Curvelet Transform Sparse Prior based Compressed Sensing

Yang,B.X.,Yuan,M.,Ma,Y.D.,Zhang,J.W.

Abstract:

Compressed sensing(CS) has shown great prospective in accelerating magnetic resonance imaging(MRI) without degrading images quality. In CS MRI, sparsity (compressibility) is a crucial premise to reconstruct high quality images from non-uniformly undersampled k-space measurements. In this paper, a novel multi-scale geometric analysis method (uniform discrete curvelet transform) is introduced as sparse prior to sparsify magnetic resonance images. The generated CS MRI reconstruction formulation is solved via variable splitting and alternating direction method of multipliers, involving revising sparse coefficients via optimizing penalty term and measurements via constraining k-space data fidelity term. The reconstructed result is the weighted average of the two terms. Simulated results on in vivo data are evaluated by objective indices and visual perception, which indicate that the proposed method outperforms earlier methods and can obtain lower reconstruction error.

R41: Pose-Specific Pedestrian Classification using Multiple Features in Far-Infrared Images

Kim,D.S.; Park,K.Y.

Abstract:

We present a multiple feature-based, pose-specific pedestrian classification approach to improve classification performance for far-infrared (FIR) images. Using pose-specific classifiers and multiple features has proved to be beneficial in visible-spectrum-based classification systems; therefore, we adapt both to an FIR-based classification system. For pose-specific classifiers, we separate poses into sets of front/back and right/left poses and estimate the pose using template matching. For feature extraction, we use histograms of local intensity differences (HLID) and local binary patterns (LBP). Experiments showed that the proposed approaches improve the classification performance of a baseline HLID/linSVM approach.

R47: Projector-Leap Motion calibration for gestural interfaces

Najman,P., Zahradka,J., Zemcik,P.

Abstract:

Calibration of a projector and a tracking device is an essential step for an interaction with a projected content using gestures. We propose a novel technique for calibration of a data projector and a Leap Motion sensor. Using the proposed approach, user can perform the calibration only by touching few points on and above the screen plane. No printed patterns, reflective markers, or additional tools are needed. The calibration process involves two steps. In the first step, we collect finger positions which we then use in the second step to find the calibration matrix and projector position. We compared the accuracy and precision of the proposed method to the accuracy and precision of

the capacitive touchscreen in a touch based interaction task. In this task we measured the Euclidean distance between the displayed and touched points. The best average distance for our method was 1.23 mm which is comparable to 0.79 mm for touch screen. The experiments demonstrate that the technique is suitable for an interaction with user interface elements designed in the common way.

R53: Content-Aware Re-targeting of Discrete Element Layouts

Hartmann,S., Krüger,B., Klein,R.

Abstract:
Example-based modeling is an active line of research within the computer graphics community. With this work we propose a re-targeting scheme for polygonal domains containing a layout composed of discrete elements. Re-targeting such domains is typically achieved employing a deformation to the initial domain. The goal of our approach is it to compute a novel layout within the deformed domain re-using the discrete elements from the initial layout. We show that the deformed interior of the initial domain can guide the layout algorithm that places the discrete elements. We evaluate our algorithm by re-targeting several challenging city blocks and the results confirm that generated layouts are visually similar to the original ones.

R61: Multiframe Visual-Inertial Blur Estimation and Removal for Unmodified Smartphones

Soros,G., Munger,S., Beltrame,C., Humair,L.

Abstract:
Pictures and videos taken with smartphone cameras often suffer from motion blur due to handshake during the exposure time. Recovering a sharp frame from a blurry one is an ill-posed problem but in smartphone applications additional cues can aid the solution. We propose a blur removal algorithm that exploits information from subsequent camera frames and the built-in inertial sensors of an unmodified smartphone. We extend the fast non-blind uniform blur removal algorithm of Krishnan and Fergus to non-uniform blur and to multiple input frames. We estimate piecewise uniform blur kernels from the gyroscope measurements of the smartphone and we adaptively steer our multiframe deconvolution framework towards the sharpest input patches. We show in qualitative experiments that our algorithm can remove synthetic and real blur from individual frames of a degraded image sequence within a few seconds.

R67: Multiscopic HDR Image sequence generation

Orozco,R., R., Loscos, C., Martin, I., Artusi, A.

Abstract:
Creating High Dynamic Range (HDR) images of static scenes by combining several Low Dynamic Range (LDR) images is a common procedure nowadays. However, 3D HDR video is not available in the market. Limitations in acquisition, processing, and display make it an active, unsolved research topic. This work analyzes the latest advances in 3D HDR imaging and proposes a method to build multiscopic HDR images from LDR multi-exposure images. Our method is based on a patch match algorithm which has been adapted and improved to take advantage of epipolar geometry constraints of stereo images. Up to our knowledge, it is the first time that an approach different than traditional stereo matching is used to obtain accurate matching between the stereo images. Experimental results show accurate registration and HDR generation for each LDR view.

R73: A Weight Adjustment Strategy to Prevent Cascade of Boosted Classifiers from Overfitting

Park,K.Y., Kim,D.S.

Abstract:
We propose a weight adjustment strategy for training a cascade of boosted classifiers to achieve an improved performance. Cascade learning is prone to overfitting due to the iterative application of bootstrapping. Since both the detection rate and the false alarm rate decrease as cascade learning goes on, an overlearned cascade tends to show a degraded detection rate and a rather improved false alarm rate. The proposed strategy evaluates the imbalance between the detection rate and the false alarm rate achieved so far at each stage and adjusts the imbalance to prevent the cascade from overfitting. Experimental results confirm the effectiveness of the proposed strategy. For experiments, face and pedestrian classifier cascades were trained by employing previous approaches and the proposed strategy. For both face and pedestrian, the detection rate of cascades was significantly improved by employing the proposed strategy.

R97: Occlusion Detection and Index-based Ear Recognition

Sultana,M., Paul,P.P., Gavrilova,M.

Abstract:
Person recognition using ear biometric has received significant interest in recent years due to its highly discriminative nature, permanence over time, non-intrusiveness, and easy acquisition process. However, in a real-world scenario, ear image is often partially or fully occluded by hair, earrings, headphones, scarf, and other objects. Moreover, such occlusions may occur during identification process resulting in a dramatic decline of the recognition performance. Therefore, a

reliable ear recognition system should be equipped with an automated detection of the presence of occlusions in order to avoid miss-classifications. In this paper, we proposed an efficient ear recognition approach, which is capable of detecting the presence of occlusions and recognizing partial ear samples by adaptively selecting appropriate features indices. The proposed method has been evaluated on a large publicly available database containing wide variations of real occlusions. The experimental results confirm that the prior detection of occlusion and the novel selection procedure for feature indices significantly improve the biometric system recognition accuracy.

S07: A Robust Temporal Depth Enhancement Method for Dynamic Virtual View Synthesis

Liu,C., Zhang,W.Z., Qi,Z.

Abstract:

Depth-image-based rendering (DIBR) is a view synthesis technique that generates virtual views by warping from the reference images based on depth maps. The quality of synthesized views highly depends on the accuracy of depth maps. However, for dynamic scenarios, depth sequences obtained through stereo matching methods frame by frame can be temporally inconsistent, especially in static regions, which leads to uncomfortable flickering artifacts in synthesized videos. This problem can be eliminated by depth enhancement methods that perform temporal filtering to suppress depth inconsistency, yet those methods may also spread depth errors. Although these depth enhancement algorithms increase the temporal consistency of synthesized videos, they have the risk of reducing the quality of rendered videos. Since conventional methods may not achieve both properties, in this paper, we present for static regions a robust temporal depth enhancement (RTDE) method, which propagates exactly the reliable depth values into succeeding frames to upgrade not only the accuracy but also the temporal consistency of depth estimations. This technique benefits the quality of synthesized videos. In addition we propose a novel evaluation metric to quantitatively compare temporal consistency between our method and the state of arts. Experimental results demonstrate the robustness of our method for dynamic virtual view synthesis, not only the temporal consistency but also the quality of synthesized videos in static regions are improved.

S23: Corrosion Rendering : Fusing Simulation and Photo-texturing

Jain,N., Kalra,P., Kumar,S.

Abstract:

We present a technique for realistic rendering of corroded objects. We employ a physio-chemically based stochastic model to determine the deterioration level of different points on an object, given its material characteristics and the vigor of the environment. Guided by values from the ISO standard, our model predicts shape degradation. This shape degradation is then applied to the object in the form of surface displacements and weathered appearance. The appearance degradation is hard to physically model accurately due to its dependence on a large number of unknown parameters as well as its high sensitivity to errors in modeling them. Hence, we instead sample from photographs of real objects to generate similar appearance for the rendered surface, but consistent with the simulated corrosion levels. We demonstrate our technique using several simulation results as well as different input photographs. We also evaluate the fidelity of the generated output to the simulation as well as to the sample texture patterns and validate our work with the help of data published in the corrosion literature. Our framework is generic and can be extended to a variety of corrosion scenarios. Ours is an important step towards predictive analysis of material loss and weathering phenomena for real objects.

S37: Performance and Quality Analysis of Convolution Based Volume Illumination

Angelelli,P., Bruckner,S.

Abstract:

Convolution-based techniques for volume rendering are among the fastest in the on-the-fly volumetric illumination category. Such methods, however, are still considerably slower than conventional local illumination techniques. In this paper we describe how to adapt two commonly used strategies for reducing aliasing artifacts, namely preintegration and supersampling, to such techniques. These strategies can help reducing the sampling rate of the lighting information (thus the number of convolutions), bringing considerable performance benefits. We present a comparative analysis of their effectiveness in offering performance improvements. We also analyze the (trascurable) differences they introduce when comparing their output to the reference method. These strategies can be highly beneficial in setups where direct volume rendering of continuously streaming data is desired and continuous recomputation of full lighting information is too expensive, or where memory constraints make it preferable not to keep additional precomputed volumetric data in memory. In such situations these strategies make single pass, convolution based volumetric illumination models viable for a broader range of applications, and this paper provides practical guidelines for using and tuning such strategies to specific use cases.

S43: An Efficient Reduction of IMU Drift for Registration Error Free Augmented Reality Maintenance Application

Lakshmiprabha,N. S., Santos,A., Beltramello,O.

Abstract:

Augmented reality (AR) is a technology that overlays virtual 3D content in the real world to enhance a user's perception. This AR virtual content must be registered properly with less jitter, drift or lag to create a more immersive feeling for the user. Pose estimation is used to accurately know the object pose in a given scene. Sensors like cameras and inertial measurement units (IMUs) are used for this purpose. Camera based vision algorithms detect the features in a given environment to calculate the relative pose of an object with respect to the camera. However, these algorithms often take a longer time to calculate the pose and can only operate at lower rates. On the other hand, an IMU can provide fast data rates from which an absolute pose can be determined with fewer calculations. This pose is usually subjected to drift which leads to registration errors. The IMU drift can be substantially reduced by fusing periodic pose updates from a vision algorithm. This work investigates various factors that affect the rendering registration error and to find the trade-off between the vision algorithm pose update rate and the IMU drift to efficiently reduce the registration error. The experimental evaluation details the impact of IMU drift with different vision algorithm pose update rates. The results show that the careful selection of vision algorithm pose updates not only reduces IMU drift but also reduces the registration error. Furthermore, this reduces the computation required for processing the vision algorithm.

S67: Adaptive Depth Bias for Soft Shadows

Ehm,A., Ederer,A., Klein,A., Nischwitz,A.

Abstract:

With shadow mapping the need of a suitable biasing technique due to shadow aliasing is indisputable. Dou et al. [Dou14] introduced a biasing technique that computes the optimal bias adaptively for each fragment. In this paper, we propose enhancements for this algorithm. First, we extend the algorithm for soft shadows, such as percentage closer filtering (PCF) and percentage closer soft shadows (PCSS). Second, we minimize the projective aliasing by introducing a scale factor depending on the ratio between surface and light direction. We show that our enhancements increase the shadow quality and introduce only a small overhead.

S89: Modeling of Predictive Human Movement Coordination Patterns for Applications in Computer Graphics

Mukovskiy,A., Land,W.M., Schack,T., Giese,M.A.

Abstract:

The planning of human body movements is highly predictive. Within a sequence of actions, the anticipation of a final task goal modulates the individual actions within the overall pattern of motion. An example is a sequence of steps, which is coordinated with the grasping of an object at the end of the step sequence. Opposed to this property of natural human movements, real-time animation systems in computer graphics often model complex activities by a sequential concatenation of individual pre-stored movements, where only the movement before accomplishing the goal is adapted. We present a learning-based technique that models the highly adaptive predictive movement coordination in humans, illustrated for the example of the coordination of walking and reaching. The proposed system for the real-time synthesis of human movements models complex activities by a sequential concatenation of movements, which are approximated by the superposition of kinematic primitives that have been learned from trajectory data by anechoic demixing, using a step-wise regression approach. The kinematic primitives are then approximated by stable solutions of nonlinear dynamical systems (dynamic primitives) that can be embedded in control architectures. We present a control architecture that generates highly adaptive predictive full-body movements for reaching while walking with highly human-like appearance. We demonstrate that the generated behavior is highly robust, even in presence of strong perturbations that require the insertion of additional steps online in order to accomplish the desired task.

S97: Kinect-Based Gait Recognition Using Sequences of the Most Relevant Joint Relative Angles

Ahmed,F., Paul,P.P., Gavrilova,M.

Abstract:

This paper introduces a new 3D skeleton-based gait recognition method that utilizes a low-cost consumer level camera, namely the Kinect. We propose a new representation of human gait signature based on the spatio-temporal changes in relative angles among different skeletal joints with respect to a reference point. Sequence of joint relative angles (JRA) between two skeletal joints computed over a complete gait cycle comprises an intuitive representation of the relative motion patterns of the involved joints. JRA sequences originated from different joint pairs are then evaluated to find the most relevant JRAs for gait

description. We also introduce a new dynamic time warping (DTW)-based kernel that takes the collection of the most relevant JRA sequences from the train and test samples and computes a dissimilarity measure between the two samples. The use of DTW in the proposed kernel makes it robust against variable walking speed and thus eliminates the need of resampling to obtain equal-length feature vectors. The performance of the proposed method was evaluated using a Kinect skeletal gait database. Experimental results show that, the proposed method can more effectively represent and recognize human gait, as compared against some other Kinect-based gait recognition methods.

T17: BoneSplit - A 3D Texture Painting Tool For Interactive Bone Separation in CT Images

Nysjö,J., Malmberg,F., Sintorn,I., Nyström,I.

Abstract:

We present an efficient interactive tool for separating collectively segmented bones and bone fragments in 3D computed tomography (CT) images. The tool, which is primarily intended for virtual cranio-maxillofacial (CMF) surgery planning, combines direct volume rendering with an interactive 3D texture painting interface to enable quick identification and marking of individual bone structures. The user can paint markers (seeds) directly on the rendered bone surfaces as well as on individual CT slices. Separation of the marked bones is then achieved through the random walks segmentation algorithm, which is applied on a graph constructed from the collective bone segmentation. The segmentation runs on the GPU and can achieve close to real-time update rates for volumes as large as 512^3. Segmentation editing can be performed both in the random walks segmentation stage and in a separate post-processing stage using a local 3D editing tool. In a preliminary evaluation of the tool, we demonstrate that segmentation results comparable with manual segmentations can be obtained within a few minutes.

T19: Hybrid client-server and P2P network for web-based collaborative 3D design

Desprat,C., Luga,H., Jessel,J-P.

Abstract:

Our proposed research project is to enable 3D distributed visualization and manipulation involving collaborative effort through the use of web-based technologies. Our project resulted from a wide collaborative application re- search fields: Computer Aided Design (CAD), Building Information Modeling (BIM) or Product Life Cycle Man- agement (PLM) where design tasks are often performed in teams and need a fluent communication system. The system allows distributed remote assembling in 3D scenes with real-time updates for the users. This paper covers this feature using hybrid networking solution: a client-server architecture (REST) for 3D rendering (WebGL) and data persistence (NoSQL) associated to an automatically built peer-to-peer mesh for real-time communication be- tween the clients (WebRTC). The approach is demonstrated through the development of a web-platform prototype focusing on the easy manipulation, fine rendering and light update messages for all participating users. We provide an architecture and a prototype to enable users to design in 3D together in real time with the benefits of web based online collaboration.

T31: Online 3D Signature Verification by using Stereo Camera & Tablet

Dave,J., Venkatesh,K.S., Jain,G.

Abstract:

The signature of a person is an important biometric attribute which can be used to authenticate human identity. Conventional online approaches to signature verification only use either a single camera to track the pen tip position or a tablet to extract the dynamic features of the signature, hence the signature has only two spatial dimensions. In this paper we combine data inputs from a pressure sensitive device (tablet digitizer) and stereo vision to record signatures in 3D. Stereo vision from a pair of low cost SONY Eyecam cameras is used to track the pen tip position in x, y, & in z when the pen is off the surface as well as the pen angle with respect to the surface at all times. The digitizing tablet on the other hand, tracks x, y as well as pressure magnitude (which we denote as -z) when the pen contacts the surface. In all, we record the following parameters as functions of time through the duration of the signature: x, y, z, theta, phi, where all the linear paramaters are bipolar, with the particular case of z representing motion with positive values and pressure level with negative values. The angular values are two dimensional. The distance between the input signature's features recorded as a 5-variate parameter time sequence and the template signature's features which were collected during the training phase is computed using Dynamic Time Warping (DTW), and is thresholded to take a decision. While better learning techniques and more intensive experimentation will help suggest improvements, even as of the present, we have a fully working prototype of the system.

T53: Vision and Virtual-based Human Computer Interaction Applications for a New Digital Media Visualization

Kerdvibulvech,Ch.

Abstract:

With the rise of smartphones and tablets interactively, human computer interaction is a very popular topic for engineers, artists, designers and computer scientists around the world in both industry and academia. This topic was studied and researched over many years ago. Nevertheless, most of previous works were studied separately between communication arts (e.g., advertising and marketing communication research) and computer science. Indeed, there has been little work giving an overview of recent integrated research of digital media and some new technologies, such as computer vision, virtual reality, and human computer interaction for visual communication. Therefore, our contribution of this paper is to discuss the recent state-of-the-art development of the digital media research work using and applying these aforementioned multimedia-based technologies. A literature review of the novel digital media and interactive augmented reality researches is also discussed. More importantly, this paper also provides a work-in-progress framework for future digital media research when applying graphical visualization, human computer interaction such as haptic, and sensor technologies into every traditional sense of human interactively, from vision to touch and from smell to taste. In general, this paper will be beneficial for any related field of interactive multimedia, communication arts and human computer interaction both industrial and educational aspects and also for any related researcher such as computer science art communicator.

SHORT PAPERS

N97: New algorithms for satellite data verification with and without the use of the imaged area vector data

Kuznetsov,A., Myasnikov,V.

Abstract:

This paper presents a solution of remote sensing data verification problem. Remote sensing data includes digital image data and metadata, which contain parameters of satellite image shooting process (Sun and satellite azimuth and elevation angles, shooting time, etc.). The solution is based on the analysis of special numerical characteristics, which directly depend on the shooting parameters: sun position, satellite position and orientation. These characteristics are based on model-oriented descriptors, proposed by one of the co-authors of this paper. We propose two fully automatic algorithms for remote sensing data analysis and decision-making based on data compatibility: the first one uses vector data of the shooting territory as a prior information, the second doesn't. After algorithms description we provide results of conducted experiments and explain appliance limits of the proposed algorithms.

O73: 3D Avatar for Automatic Synthesis of Signs for The Sign Languages

Golçalves,D.A., Todt,E., García,L.S.

Abstract:

This paper discusses a synthesis system that generates, from a XML input representing gesture descriptors, a vector of configuration parameters that are executed by a 3D Avatar for use in the animation of Sign Languages. The development of virtual agents able to reproduce gestures of sign languages is very important to the deaf community, since in general they also have difficulties to read conventional texts. In this research project, a consistent combination of 3D editor Blender, CMarkup parser and graphics engine Irrlicht was used to develop a novel approach to sign synthesis, based on a recent XML model that describes hand gestures using shape, location, movement and orientation descriptors. The described experiments validate the proposed implementation model, which constitutes a promising alternative in the area of synthesis of signals for computational applications of Sign Languages.

O89: Applying Filters to Repeating Motion based Trajectories for Video Classification

Ayyildiz,K., Conrad,S.

Abstract:

The presented video classification system is based on the trajectory of repeating motion in video scenes. Further on this trajectory has a certain direction and

velocity at each time frame. As the position, direction and velocity of the motion trajectory evolve in time, we consider these as motion functions. Later on we transform these functions by FFT and receive frequency domains, which then represent the frequencies of repeating motion. Moreover these frequencies serve as features during classification phase. Our current work focuses on filtering the functions based on the motion's trajectory in order to reduce noise and emphasize significant parts.

P05: Efficient Linear Local Features of Digital Signals and Images: Computational and Qualitative Properties

Myasnikov,V.

Abstract:

The paper presents the analysis of efficiency of two original approaches to the construction of the sets of linear local features (LLF), which are used for digital signal and image processing. The first approach is based on generating of LLF set, which consists of separately constructed efficient LLFs, each of which has its own algorithm for feature calculation. The second approach assumes the construction of an efficient LLF set, which has a single algorithm for joint simultaneous computation of all features. The analysis is carried out by several indicators that characterize the computational and qualitative properties of the constructed LLFs.

P11: Anomaly Detection Using Spectral Mismatch Between Anomaly Pattern and its Neighborhood

Denisova,A., Myasnikov,V.

Abstract:

In this paper we present a novel algorithm for anomaly detection in multichannel images. Proposed algorithm uses spectral mismatch criterion to describe anomalous properties of small image regions. The idea behind the criterion is that the brightness of the anomalous region can't be represented as a function of pixels comprising that region. In our paper, we consider a local pattern of anomaly and its neighborhood, and we use a linear function to approximate the anomaly at each image position. In contrast to existing global and local RXD algorithms our approach allows more adaptive and noise resistant detection of anomalies. Experimental results are presented for hyperspectral remote sensing images.

P19: Visual Encoding of Automatic Identification Data (AIS) for Radar Systems

Last,P., Hering-Bertram, M., Jung, T., Linsen, L.

Abstract:

The Automatic Identification System (AIS) is a maritime system mostly used for automatically exchanging tracking and other relevant information between vessels. It supports decision making of nautical personnel such as master mariners. AIS data are multivariate including many aspects for identification and localization of ships and for navigation. However, during navigation not all AIS data are made visually available to the nautical personnel. In this paper, we propose a glyph-based visualization consistent with currently used encodings for intuitively and effectively encoding further so far missing AIS data attributes on radar screens. Proposed extensions aim at increasing maritime safety by helping mariners to assess traffic situations. We applied our visualization methods to real-world data recorded at the German North Sea coast and evaluated them with the help of an expert group.

O41: A framework for robust object multi-detection with a vote aggregation and a cascade filtering

Kurzejamski,G., Zawistowski,J., Sarwas,G.

Abstract:

This paper presents a framework designed for the multi-object detection purposes, adjusted for application of product search on the market shelves. The updated testing framework uses a single feedback loop and a pattern resizing mechanism to demonstrate the top effectiveness of state-of-the-art local features. High detection rate with low false detection rate can be achieved with use of only one pattern per object and no manual parameters adjustments. The method incorporates well known local features and a basic matching process to create a reliable voting space. Further steps comprise of metric transformations, graphical vote space representation, two-phase vote aggregation process and cascade of verifying filters.

P73: 3D Reconstruction of Outdoor Scenes Using Structure from Motion and Depth Data

Fujimoto,K., Watanabe,T.

Abstract:

Recently, low-cost and small RGB-D sensors appear massively at the entertainment market. These sensors can acquire colored 3D models using color images and depth data. However, a limitation of the RGB-D sensor is that sunlight interference with the pattern projecting LED. The sensor is most suitable only for indoor scenes. In this research, we developed a novel measurement method for RGB-D sensors, which can measure shapes in outdoor scenes. This method uses several measurement data from multiple viewpoints, and estimates the shape and the sensor poses using Structure from Motion (SfM). However, a conventional image-based SfM cannot determine a correct scale. To determine the correct scale, our method uses the depth information that is obtained from partially

acquired area which is near to the viewpoints. Then, our method optimizes the shape and the poses by a modified bundle adjustment with the depth information. It minimizes the reprojection error of the features in the acquired images and the depth error between the estimated model and the measurement depth. At last, our method generates dense point cloud using a multi-view stereo algorithm. Using both the acquired images and depth data, our method reconstructs the shape which locates out of measurement range in outdoor environment. In our experiment, we show that our method can measure the range up to 20 meters away by measuring from several viewpoints in the range of 5 meters using a RGB-D sensor in outdoor scenes.

Q03: Introducing Aesthetics to Software Visualization
Baum,D.
Abstract:
In software visualization there is a great need for empirical evaluation of visualization metaphors. This paper lays a foundation towards an alternative approach that has the potential to reduce the required number of empirical studies since it is computable. It is based on measurable aesthetic heuristics that are used to estimate the perception and the processing of software visualizations. For that purpose the repertory grid technique is used to identify aesthetics that are metaphor-specific and relevant to the user in a structured and repeatable way. We identified 25 unique aesthetics and revealed that the visual appearance of the investigated visualizations is mainly influenced by the package structure whereby methods are underrepresented. These findings were used to improve existing visualizations.

Q43: Hyperspectral Image Classification Using a General NFLE Transformation with Kernelization and Fuzzification
Chen,Y.-N., Wang,Y.-Ch., Han,Ch-Ch., Fan,K-Ch.
Abstract:
Nearest feature line (NFL) embedding (NFLE) is an eigenspace transformation algorithm based on the NFL strategy. Based on this strategy, the NFLE algorithm generates a low dimensional space in which the local structures of samples in the original high dimensional space are preserved. Though NFLE has successfully demonstrated its discriminative capability, the non-linear manifold structure cannot be structured more efficiently by linear scatters using the linear NFLE method. To address this, a general NFLE transformation, called fuzzy/kernel NFLE, is proposed for feature extraction in which kernelization and fuzzification are simultaneously considered. In the proposed scheme, samples are projected into a kernel space and assigned larger weights based on that of their neighbors according to their neighbors. In that way, not only is the non-linear manifold structure preserved, but also are the discriminative powers of classifiers increased. The proposed method is compared with various state-of-the-art methods to evaluate the performance by several benchmark data sets. From the experimental results, the proposed FKNFLE outperformed the other, more conventional, methods.

Q61: Over- and Under-Segmentation Evaluation based on the Segmentation Covering Measure
Sigut,J., Fumero,F., Nunez,O.
Abstract:
Very few measures intended for evaluating the quality of image segmentations account separately for over- and under-segmentation. This distinction is highly desirable in practice because in many applications under-segmentation is considered as a much serious issue than over-segmentation. In this paper, a new approach to this problem is presented as a decomposition of the Segmentation Covering measure into two contributions, one due to over-segmentation and the other one to under-segmentation. Our proposal has been tested on the output of state-of-the-art segmentation algorithms using the Berkeley image database. The results obtained are comparable to those provided by similar evaluation methods allowing a clear separation between over- and under-segmentation effects.

Q67: Interactive Tool and Database for Optic Disc and Cup Segmentation of Stereo and Monocular Retinal Fundus Images
Fumero, F., Sigut, J., Alayón, S., González-Hernández, M., González de la Rosa, M.
Abstract:
Glaucoma is one of the leading causes of irreversible blindness in the world. Early detection is essential to delay its evolution and avoid vision loss. For this purpose, retinal fundus images can be used to assess the cup-to-disc ratio, the main indicator of glaucoma. Several automatic methods have been developed to compute this indicator, but the lack of ground truth of the optic disc and cup is an obstacle to evaluate and compare their results. In order to support clinicians to perform this task, an interactive tool for the segmentation of the disc and cup on stereo and monocular retinal fundus images has been developed. By using this tool, we have also built a new database of 159 stereo fundus images with two ground truth of disc and cup. The application and the database are both publicly available online. This work can serve as a learning environment for clinicians, as well as to

evaluate the results of automatic segmentation algorithms.

Q89: Edge-aware Normal Estimation by Rotated Bilateral Sampling

Kovacs,V., Tevesz,G.

Abstract:

In this paper we deal with edge preserving surface normal estimation and crease edge detection in discretized range images. Such range images consist of few discrete quantization levels due to the data acquisition method (short base distance stereo), or when the distance variation of the examined surface is low, compared to the disparity quantization levels. We propose a method for normal estimation and crease edge detection using iso-range curves and rotated bilateral filter based sampling. Samples are first selected by a rotated weight matrix and a plane is fitted on such samples. Simple statistics are gathered during the rotation of the weight matrix, in order to find the best fitting plane and extract crease edge measure. Such information may be used for further range image processing: segmentation, mapping, localization, object detection, recognition etc. Results are shown for both synthetic and real range images. It was shown that applying the proposed method resulted in more accurate normal estimations, crease edges were not smoothed and crease edges were successfully detected.

R11: Surfaces for Point Clouds using Non-Uniform Grids on the GPU

Schiffner, D., Stockhausen, C., Ritter, M.

Abstract:

Clustering data is a standard tool to reduce large data sets, such as scans from a LiDAR, enabling real-time rendering. Starting from a uniform grid, we redistribute points from and to neighboring cells. This redistribution is based on the properties of the uniform grid and thus the grid becomes implicitly curvilinear, which produces better matching representatives. Combining these with a polygonal surface reconstruction enables us to create interactive renderings of dense surface scans. Opposed to existing methods, our approach is running solely on the GPU and is able to use arbitrary data fields to influence the curvilinear grid. The surfaces are also generated on the GPU to avoid unnecessary data storage. For evaluation, different data sets stemming from engineering and scanning applications were used and have been compared against typical CPU based reconstruction methods in terms of performance and quality. The proposed method turned out to reach interactivity for large sized point clouds, while being able to adapt to the point clouds geometry, especially when using non-uniform sampled data.

S19: Separable Convolution Gaussian Smoothing Filters on a Xilinx FPGA platform

Talbi,F., Alim,F., Seddiki,S., Mezzah,I., Hachemi,B.

Abstract:

Convolution Gaussian filtering is a technique that can be used for a wide array of image processing tasks, some of which may include smoothing, edge detection, line parameter estimation and texture analysis. The greatest advantage of the Gaussian filters is that they are separable. Our main goal in this paper is to develop an efficient architecture for Separable Gaussian smoothing filters using intermediate controller based on Finite State Machine simulated in VHDL and prototyped on device technology of XILINX VirtexV FPGA platform. The proposed separable filtering approach is significantly faster and occupied few resources in terms of number of clock cycles and number of multipliers compared to the general two-dimensional convolution implementation. This difference is very important for larger mask sizes because hardware complexity is widely reduced

S31: VideoMR: A Map and Reduce Framework for Real-time Video Processing

Meier,B., Trapp,M., Döllner,J.

Abstract:

This paper presents StreamMR: a novel map and reduce framework for real-time video processing on graphic processing units (GPUs). Using the advantages of implicit parallelism and bounded memory allocation, our approach enables developers to focus on implementing video operations without taking care of GPU memory handling or the details of code parallelization. A prototypic implementation using OpenGL facilitates various operating platforms, including mobile development, and will be widely interoperable with other state-of-the-art video processing frameworks.

S59: Perspective Correction of Panoramic Images created by Parallel Motion Stitching

Goncalves,J., Ribeiro,D., Soares,F.,

Abstract:

This paper deals with the problem of correcting the perspective distortion in panoramic images created by parallel motion stitching. The distortion is revealed by lines that appear to converge at the infinity, but are actually parallel. A camera cart shoots from multi-viewpoints aiming a parallel motion to the scene that is photographed. The perspective effect arises on panoramas while stitching several images taken from the camera, slightly panning in both directions

between shoots along the motion path. In this paper, we propose a solution to handle different camera translation motions and be able to stitch together images with a high-level of similarity, also having repetition patterns along a vast continuity of elements belonging to the scene. The experimental tests were performed with real data obtained from supermarket shelves, with the goal of maintaining the correct amount of product items on the resulting panorama. After applying the perspective correction in the input images, to reduce cumulative registration errors during stitching, it is possible to extract more information about the similarity between consecutive images so that matching mistakes are minimized.

S61: News Patterns: how press interacts with social networks

Boettcher,G.B., Freitas,C.D.S, Comba,J.

Abstract:

Social media has played a big part in the adaptation process for newspapers and magazines, but innovating while going through a recession has led to a hasty evolution and automated processes for very different media. While existing social media studies and state of the art visual solutions are available for analyzing social media content and users' behaviors, no other method is optimized for finding patterns from a popularity standpoint in the specialized realm of news channels. In this paper, we propose the usage of a combination of different visualization techniques that co-relate the profile's and its reading community activities with the resulting popularity. For the period of three months, we gathered Twitter posts, the number of followers and trending topics from worldwide press profiles. We used this dataset as the seed for our bar charts, tag clouds and bubble charts to allow for multiple source comparison, so that not only the user is able to understand their own community but also the success and pitfalls faced by the competition in the same medium. We validate our analysis by interviewing a group of journalists from different established newspapers. Through interacting with our system, it was possible to reveal hidden patterns in the massive dataset of messages and comments worldwide enabling the user to have unique insight into their community's behaviors and preferences.

S73: A Geodesic Based Approach for an Accurate and Invariant 3D Surfaces Representation

Jribi,M., Ghorbel,F.

Abstract:

In this paper, we propose a novel 3D invariant surface representation under the 3D motion group M(3). It is obtained by combining two main representations: the three polar representation and the one defined by the radial line curves from a starting point. The retained invariant points correspond to the geometrical locations of the intersection between the two last representations. The approximation of the novel surfaces description method on the 3D discrete meshes is studied. Its accuracy for the 3D faces description and retrieval is evaluated in the mean of the Hausdorff shape distance.

T11: Analysis of 3D Mesh Correspondences Concerning Foldovers

Merz,J., Getto,R., von Landesberger,T.

Abstract:

Foldovers (i.e., folding of triangles in a 3D mesh) are artifacts that cause problems for morphing. Mesh morphing uses vertex correspondences among the source and the target mesh to define the morphing path. Although there exist techniques for making a foldover-free mesh morphing, identification and correction of foldovers in existing correspondences is still an unsolved issue. This paper proposes a new technique for the identification and resolution of foldovers for mesh morphing using predefined 3D mesh correspondences. The technique is evaluated on several different meshes with given correspondences. The mesh examples comprise both real medical data and synthetically deformed meshes. We also present various possible usage scenarios of the new algorithm, showing its benefit for the analysis and comparison of mesh correspondences with respect to foldover problems.

T23: Robust Human Gesture Recognition from 3D Data

Kurmi, V.K., Jain, G., Venkatesh, K.S.

Abstract:

In this paper, we use the output of a 3D sensor (ex. Kinect from Microsoft) to capture depth images of humans making a set of predefined hand gestures in various body poses.

Conventional approaches using Kinect data have been constrained by the limitation of the human detector middleware that requires close conformity to a standard near erect, legs apart, hands apart pose for the subject. Our approach also permits clutter and possible motion in the scene background, and to a limited extent, in the foreground as well. We make an important point in this work to emphasize that the recognition performance is considerably improved by a choice of hand gestures that accommodate the sensor's specific limitations. These sensor limitations include low resolution in x and y as well as z. Hand gestures have been chosen (designed) for easy detection by seeking to detect a fingers apart, fingertip constellation with minimum computation. without,

however compromising on issues of utility or ergonomy. It is shown that these gestures can be recognised in real time irrespective of visible band illumination levels, background motion, foreground clutter, user body pose, gesturing speeds and user distance. The last is of course limited by the sensor's own range limitations. Our main contributions are the selection and design of gestures suitable for limited range, limited resolution 3D sensors and the novel method of depth slicing used to extract hand features from the background. This obviates the need for preliminary human detection and enables easy detection and highly reliable and fast (30 fps) gesture classification.

T47: Point triangulation using Graham's scan

Tereshchenko,V., Tereshchenko,Y.

Abstract:

In this paper, we propose a triangulation method for a set of points in the plane. The method is based on the idea of constructing convex layers by Graham's scan. It allows to develop an algorithm with the optimal complexity of O(NlogN) and an easy implementation. First, convex hulls are constructed for the set S of N points, forming k layers. Then, each layer is triangulated in one scan of the adjacent convex hulls. Algorithm is easily parallelized: each layer can be triangulated independently. The main feature of the proposed algorithm is that it has a very simple implementation and the elements (triangles) of the resulting triangulation are presented in the form of simple and at the same time fast data structures: concatenable triangle queue or triangle tree. This makes the algorithm convenient for solving a wide range of applied problems of computational geometry and computer graphics, including simulation in science and engineering, rendering and morphing

T59: Inpainted image quality assessment based on machine learning

Voronin,V.V., Marchuk,V.I., Semenishchev,E.A.

Abstract:

In many cases inpainting methods introduce a blur in sharp transitions in image and image contours in the recovery of large areas with missing pixels and often fail to recover curvy boundary edges. Quantitative metrics of inpainting results currently do not exist and researchers use human comparisons to evaluate their methodologies and techniques. Most objective quality assessment methods rely on a reference image, which is often not available in inpainting applications. This paper focuses on a machine learning approach for no-reference visual quality assessment for image inpainting. Our method is based on observation that Local Binary Patterns well describe local structural information of the image. We use a support vector regression learned on human observer images to predict the perceived quality of inpainted images. We demonstrate how our predicted quality value correlates with qualitative opinion in a human observer study.

POSTERS

O03: Hand vein authentication based wavelet feature extraction

Benziane,S., Benyettou,A.

Abstract:

Biometrics is a growing scientific field. It aims to identify, through technological systems, an individual, using biological characteristics (eg details of hand, iris, ear, hand lines, fingerprints, gait, posture,). The Using of this technique is now generalized worldwide and takes an important place in everyday life. In the coming years, biometrics will probably be one of the techniques used, first to identify or authenticate individuals and also to control and manage access to material resources, particularly in the following sectors: banking, airports, bus and railway stations, hospitals, private and public institutions, homes, smart cars, museums, ...).The aim of our study is to build a dorsal hand vein database and test our approach on it. Just like any recognition system this last is composed of four steps: the acquisition, enhancement, feature extraction and classification. This paper presents the building protocol of a new database SAB11 BIOM14. Applying some enhancement on the database's image was required to get it ready for a real biometric's application. To validate our tests we proposed a new adaptive feature extraction method for the dorsal hand vein biometrics; which is the discrete wavelet transform.

O17: Symbolic-graphic design of Pk x Pm Segre varieties in the Pn space

Volkov,V., Yurkov,V., Chizhik,M., Moskovtsev,M.

Abstract:

In the paper multidimensional enumerative geometry apparatus and the parameterization theory are used to investigate Segre varieties of Pk x Pm kind in the Pn space. A number of theorems proved on the structure of varieties bundle and structural characteristics. Using the symbolic representation of the incidence conditions a table compiled for projective space (Pk + 1) x (Pm + 1) - 1 and the Segre surface Pk + Pm and their orders for the case of k, m = 10. Ruled varieties can be used as a geometric model of technological processes.

O37: Hyperspectral images repository using a hierarchical compression

Gashnikov,M., Glumov,N.

Abstract:

The possibilities of hierarchical compression in hyperspectral images repository are investigated. The image analysis of 'SpecTIR' and 'AVIRIS' hyperspectrometers is carried out. In order to increase the compression ratio, the spectral bands approximation algorithms are proposed to provide fast access to individual bands. The effectiveness of the developed algorithms is investigated through computational experiments using real 16-bit hyperspectral images.

O53: Simulating Small-Scale Object Stacking Using Stack Stability

Thomsen,K., Kraus,M.

Abstract:

This paper presents an extension system to a closed-source physics engine for improving structured stacking behavior with small-scale objects such as wooden toy bricks. The proposed system was implemented and tested in both a technical test and a user test. The technical test showed that the proposed system is able to simulate the tested stacking scenarios. The user test, however, found the proposed system less visually plausible than the base physics engine with unphysical parameters, which were optimized for stacking small-scale objects.

O83: Robust Hand Segmentation and Tracking During Occlusion in Sign Language

Maher,J., Mohamed,J.

Abstract:

Relative to document recognition, it is challenging to analyse and recognize sign language. There is several problems confronted in the automatic processing literature of sign language. The aim of this paper is to develop methods that are adapted for sign language processing and generally not constrained to a small vocabulary or a specific context. The automatic system of recognition consists on a skin model, body tracking and hand segmentation.

P07: Efficient Representation of Range Face Images Using Vectorfaces

Ganguly,S., Bhattacharjee,D., Nasipuri,M.

Abstract:

Advancement in scientific representation should accelerate the processing of images if it is more relevant and worthy with the experiment. Scientific visualizing of data (here, face images) has an enormous impact on exploring detailed inner content of images. Hence, the quality of processing depends on the quantity and informative data that might be accumulated, preserved as well as visualized in a particular image. In this paper, authors have described a novel technique for representation of range face image by "Vectorfaces", which is proved to be more effective towards better recognition purpose in terms of recognition rate. Range face image is particularly important for 2D visual images for accomplishing depth

data from 3D images. Other than an efficient representation of "Vectorfaces" images, authors have also emphasized its significance for selecting better features compared to conventional range images. The major goal of the present work reported in this article is to evaluate, visualize and compare the role of "Vectorfaces" over range face images. Change of tracks for different mathematical notations to visualize the images are noted. Moreover, Mean-Maximum curvature image pair is accumulated from range image as well as "Vectorfaces" for extraction of features. SVD, followed by a feed-forward backpropagation neural network have been used for recognition purpose. In this work, 3D face images from Frav3D database have been considered. A statistical evaluation of this investigation is also given in the case study section.

P29: Automated Detection of Buildings on Aero Images

Novotortsev,L., Voloboy,A.

Abstract:

One of the challenging problems in photogrammetry is extracting of three-dimensional objects from aero images, in particular, extraction of different kinds of buildings. All methods that provide satisfactory results are rather time consuming and process data quite long. In the paper we propose a method that detects areas on aero images that might contain a building behind them. Our method allows reducing the amount of data which should be processed by more complex algorithms. This leads to reducing of the total time spent on extraction process.

P37: Using Intrinsic Surface Geometry Invariant for 3D Ear Alignment

Taertulakarn,S., Tosranon,P., Pintavirooj,C.

Abstract:

In this study we derive novel surface fiducial point's detection that is computed from the differential surface geometry. The fiducial points are intrinsic, local, and relative invariants, i.e., they are preserved under similarity, affine, and nonlinear transformations that are piecewise affine. In our experiment, the fiducial points, computed from high order surface shape derivatives, are used in a non-iterative geometric-based method for 3D ear registration and alignment. The matching is achieved by establishing correspondences between fiducial points after a sorting based on a set of absolute local affine invariants derived from them. Experimental results showed that our purposed surface feature is suitable for further application to 3D ear identification because its robustness to geometric transformation.

P67: A new 6D ICP algorithm with color segmentation-based adaptive sampling

Kim,E.S., Choi,S.I., Park,S.Y.

Abstract:

3D registration is a computer vision technique of aligning multi-view range images with respect to a reference coordinate system. Various 3D registration algorithms have been introduced in the past few decades. Iterative Closest Point (ICP) algorithm introduced by Besl and McKay[Besl92a] is one of vastly used 3D registration algorithm, which got various modification later on. In ICP-based algorithms, the closest points are considered as the corresponding points. However, this method fails to find matching points accurately when the initial position of the point clouds is not sufficiently close. In this paper, we propose a new method to solve this problem using 6D distance, which consists of color information and 3D distance, and color distribution matching. First, before finding the corresponding points using this method, a Gaussian filter is applied on the input color image. A color based image segmentation is done on that image and then n number of samples are randomly chosen from each segment. This process is applied in order to improve the computational time and performance. Second, corresponding point candidates are searched by solving a local minima problem using 6D distance. Then the color distribution matching is applied on these candidates to find the final corresponding point. Several experiments are conducted to evaluate the proposed method and the experiment results prove it has improved over the conventional methods.

Q02: A COM-based Toolkit for Real Time Volume Visualization

Maas,S., Overhoff,H.M.

Abstract:

Medical image data processing can become challenging due to high acquisition rates. Toolkits like VTK or MITK are incapable of handling such data rates in real time. Processing speedup can be gained by using graphical processing units (GPUs), but only with efficient GPU-CPU communication and data exchange. While GPU host programs are implemented in languages like OpenGLSL or OpenCL C, CPU client code is written in languages like C++ or Java. Combining modules from different languages is possible using the Component Object Model (COM). Collaborative software development in different languages is not unusual. But this leads to minor resource utilization during collaborating as a result of porting or reprogramming needs. Additionally in cooperative projects frequently legal and market economy issues prohibit an exchange of source code between the project partners. COM offers an efficient way to combine modules from

several development teams. To solve the common issues of collaborative software development and to fulfil the needs of a real time visualization toolkit 'RTVCOM' was designed and realized. To demonstrate the capability of this approach an example client was developed that combines COM-objects written in OpenCL C, OpenGLSL, C++ and C#. It acquires raw data streams at 45.2 MB/s from an ultrasound device, reconstructs the associated volume data and visualizes them in real time. The visualization is fully interactive, and different post processing filters can be applied. For comparison purposes a VTK-based program was developed that was capable to handle the same raw data stream with less than 3 MB/s.

Q37: An alternative green screen keying method for film visual effects

Zhi,J.

Abstract:

This study focuses on a green screen keying method developed especially for film visual effects. There are a series of ways of using existing tools for creating mattes from green or blue screen plates. However, it is still a time-consuming process, and the results vary especially when it comes to retaining tiny details, such as hair and fur. This paper introduces an alternative concept and method for retaining edge details of characters on a green screen plate, also, a number of connected mathematical equations are explored. At the end of this study, a simplified process of applying this method in real productions is also tested.

Q53: The creation of serious games intended for historically oriented subjects at the 1st level of

Chadimova,L.

Abstract:

The aim of the project is to create education games (serious games) for important historical buildings in each region of Czech Republic. These games will guide users through historical buildings and will provide them with the information about architecture, history of building, or about its surroundings and suchlike. For the creation of serious games are used tools of 3D graphic software 3Ds MAX in combination with developing software UNITY 3D. In the modelling software 3Ds MAX were created 3D models of historical buildings. The game environment is created in UNITY 3D with the aid of programming language C#.

Q47: Virtual Museum as an Environment for Visual Representation of Urban Planning Concepts and Lost Architectural Objects

Petrova,Y.

Abstract:

Intensive development of the Web has significant influence on social communication processes. New trends of information distribution demand new approach for being involved in on-line communication. Social institutions, including museums and exhibition centers, aim to develop their presence on the Web, searching for ways to engage bigger number of visitors by offering them new experience. There are different forms of museum presence in virtual environment: from digital museums based only on tangible museums' collections to virtual museums, which content is supplemented to a large degree with objects that exist only in the virtual space. The main subject of the research is effectiveness of online tools for representation of large architectural and urban objects, unimplemented projects and lost monuments. The other target is to study advantages and potential of virtual museums. Virtual exhibition is often based on the products of virtual reconstruction. It is very important to formulate strict methods of this approach, to develop a method and establish a practice of visual distinction between true (and/or relatively true) parts of a virtual model and its authorial parts.

Q83: Improving Situational Awareness in Military Operations using Augmented Reality

Mitaritonna A., Abásolo, M.

Abstract:

During military operations, the battlefields become fractured zones where the level of confusion, noise and ambiguity impact on how to achieve tactical objectives. Situational Awareness (SA) becomes a challenge because the perception of the situation is unstable, leading to degraded understanding and the inability of the soldier in projecting the proper results. To meet this challenge various military projects have focused their efforts on designing integrated digital system to support decision-making for military personnel in unknown environments. This paper presents the state of art of military systems using Augmented Reality (AR) in the battlefield.

Q97: Conditional Random Fields For Web User Task Recognition Based On Human Computer Interaction

Elbahi,A., Omri,M.N.

Abstract:

Recognition activity of web users based on their navigational behavior during interaction process is an important topic of Human Computer Interaction. To improve the interaction process and interface usability, many studies have been performed for understanding how users interact with a web interface in order to perform a given activity. In this paper we apply the Conditional Random Fields approach for modeling human navigational behavior based on mouse

movements to recognize web user tasks. Experimental results show the efficiency of proposed model and confirm the superiority of Conditional Random Fields approach with respect to the Hidden Markov Models approach in human activity recognition.

R03: Detection and tracking of vehicles based on the videoregistration information

Kopenkov,V., Myasnikov,V.

Abstract:

The paper describes an information technology of detection and tracing vehicles on the sequence of images based on digital video stream analysis in the real-time mode. Such technology can be used for car identification, license plates recognition, and moreover for defining of car traffic parameters: the cars speed and average speed of a car traffic, the traffic density (number of vehicles per unit time), and so on.

R37: A Novel Retinex Model Based on Sparse Source Separation

Choi,J., Kim,Y., Choe,Y.

Abstract:

Retinex was introduced by E.Land to explain and solve a problem of color constancy in human visual system (HVS). In this paper, we propose a novel Retinex model based on sparse source separation problem. Different from the existing models, we can explain a relation between the modeling and the effectiveness of Retinex de-composition with the proposed model. We demonstrate the performance of our model by experimental results.

R79: Local Monte Carlo estimation methods in the solution of global illumination equation

Chembaev,V.D, Zheltov,V.S., Budak,V.P., Notfulin,R.S

Abstract:

In this article, we consider local estimations of the Monte Carlo method for solving the equation of the global illumination. The local estimations allow directly calculating the luminance at a predetermined point in a given direction. Whereby based on it can be built visualization of 3D scenes. The article discusses the visualization of 3D scenes with the optimization of the number of calculation points for higher order reflections based on the original mesh scene. Also considering the possibility of a species independent visualization of 3D scene based on the brightness object decomposition in spherical harmonics.

S02: Reasoning about Graph Algorithm Visualization

Gordeev,D.

Abstract:

A method of graph algorithm visualization based on an implicit visual effect generation approach is described. The approach develops an idea to establish an algorithm as an input as well as input graph. Visualization of algorithms is carried out by means of a set of configurable visual effects. We consider a class of hierarchical graphs as a class of input graphs. This allows using wide set of input graphs and presenting additional data appearing during the algorithm work as part of a single visualized graph model. Described approach is be used both in research and education.

S17: Computed Tomography Image Analysis: the Model of Ribs-Bounded Contour

Bilinskas,M.J., Dzemyda,G., Trakymas,M.

Abstract:

In this paper, a method for analyzing transversal plane images from computer tomography scans is presented. This method allows not only the approximation of ribs-bounded contour but also the evaluation of patient rotation around the vertical axis during a scan. A mathematical model that describes the ribs-bounded contour was created and the problem of approximation is solved by finding out the optimal parameters of the mathematical model using least-squares.

S29: Computer Vision Framework for Object Detection: FrODet

Castro,G., Oliveira,P.

Abstract:

Despite the increasing interest, most computer vision researchers are still missing a base system that could help them build projects focused on object detection. The lack of a framework designed for this purpose leads to an unnecessary time investment on building good software architecture or not having one at all, resulting in a hard-to-maintain system. Our paper proposes FrODet, a generic framework that enables researchers to focus only on specific software design issues and shows how this solution can help throughout the usual algorithm tests and their adjustments. We provide an abstract class architecture allowing easy module replacement and an easy way to create new ones. Thanks to its abstraction it is possible to automatically test any desired algorithm.

S53: Statistical solution of 3D transformation problem

Marek,J., Rak,J. Jetensky,P.

Abstract:

Obtaining the 3D model of an object is currently one of the most important issues that image processing is dealing with. Measurement of the points on 3D objects requires different scans from different positions in different coordinate systems. At our disposal can be measured coordinates of an identical point, which can be obtained from a laser 3D scanner, Microsoft Kinect

etc. A point whose coordinates are known in both coordinate systems is called an identical point. Data transformation of identical points from one coordinate system to another coordinate system is therefore required. The aim of this contribution is to present a possible approach on how to estimate the unknown transformation parameters by regression models in a special transformation problem. This transformation in its standard version has been derived under the assumption that non-negligible random errors occur at points of that coordinate system into which the transformation is performed; points of the inverse image coordinate system are assumed to be errorless.

S79: Hough Transform for the Calculation of Twist Angle of Aramid Torsion

Perechesova,A.D., Soloveva,G.A., Kalapyshina,I.I.

Abstract:

Aramid yarns are widely used for various technical applications. For example, they are used for creation of a magnetosensitive element of the torsion magnetometer, which is a part of the geophysical complex GI-MTS-1 (SPbF IZMIRAN). Such element is made of three microfilaments of aramid yarn. Study of such physical-mechanical characteristics of yarns as tensile, shear and torsion moduli, is necessary for improvement torsion magnetometer. This paper describes the preparatory phase of experimental study of yarn twist angle variation during tensile test. It includes equipment description, in particular, description of the scheme of video capture, and developed computer vision algorithm for determining an aramid torsion slope angles. Proposed scheme of video capture includes high-speed camera and allows precise focusing due to two-coordinate platform and avoiding of optical distortions. A special computer vision algorithm, which based on the Hough transform, was developed. This algorithm was tested on torsion images obtained with digital microscope. The algorithm works with different real yarns regardless of their color and twist type.

S83: Feature based assessment of forming force behavior in Incremental Sheet Forming

Priyadarshi,S., Jain,P.K., Roy,J.J., Samal,M.K., Tandon,P.,

Abstract:

Forming forces and their behavior plays an important role in defining the mechanism of any sheet metal forming process. In Incremental sheet forming, due to inherent complexities, study of forming force behavior is a challenging task. In absence of geometry independent techniques, only studies specific to certain axisymmetric and planer symmetric geometries are available. Present work deals with development of a novel methodology for the study of behavior of forming forces in geometries with multiple features by mapping components of forming forces obtained with dynamometer readings to spatial coordinates of tool path coordinates. Techniques such as Nearest Neighbor Search, RANSAC and calculation of l2 norm are employed for this very purpose.

T02: Building 3D Object Representation Using SURF Local Features

Jaszuk,M., Szostek,G., Starzyk,J.A.

Abstract:

The paper discusses an approach to create 3D representation of physical objects. The aim is creating a visual representation of an object, which allows for robust recognition, irrespectively of the distance and the direction of observation. The approach uses a set of rotational views of an object, which are transformed into a set of keypoints using the SURF visual feature detector. The key points are then collected to build a 3D model of the object. Such representation allows both for recognizing the objects based on local characteristics, and distinguishing different global geometry transformations that are needed to recognize the object in its 3D environment.

T29: Image Segmentation Using Similarity Filtering Based Multilevel Thresholding

Bhatia,S., Kar,A., Gupta,G.

Abstract:

In this paper we present a method for segmenting images quickly and effectively. The proposed algorithm is discussed which segments the image on the basis of the threshold points obtained by using Gaussian distributions on histogram data. The importance of this algorithm lies in the fact that it is quick as well as accurate. The performance is evaluated by comparing the results with those obtained by applying Otsu's multilevel thresholding.

T67: Signal and Image Processing in the Center of Cuba: Center for Studies on Electronics and Information Technologies (CEETI)

Ferrer,C., Taboada-Crispi,A.; Lorenzo-Ginori,J.V.

Abstract:

A brief description of CEETI is given, addressing its history, research lines and main results

T71: Computer Graphics and Vision Labs in Argentina

De Giusti,A.; Abásolo,J.M; Naiouf,M. Castro,S., Guerrero,R.

Abstract:

This article describes the Computer Graphics and Vision research that are being developed by three universities'; laboratories in Argentina: III-LIDI Institute

of Computing Research at National University of La Plata, VyGLab Visualization and Computer Graphics Laboratory at South National University, and CGLab Computer Graphics Laboratory at National University of San Luis.

Abstracts prepared according to corresponding author's registration data.

WSCG 2015 Conference Schedule

Registration: Monday, June 8, 17:30 - 20:30, Primavera hotel, **Conference office is open during breaks, only**

Tuesday, June 9, 2015

	8:30 - 10:00	30'	10:30 - 12:00	20'	12:20 - 13:30	13:30 - 15:00	30'	15:30 - 17:00	17:00 - 17:30
Room A	Session A Full	Break	Session C Full	**Welcome**	Lunch	Session E Full	Break & Posters A	Session G Full	LATE registra-tion
Room B	Session B Short		Session D Short			Session F Full		Session H Full	

Wednesday, June 10, 2015

	8:30 - 10:00	30'	10:30 - 12:00	20'	12:20 - 13:30	13:30 - 15:00	30'	15:30 - 17:00	17:59
Room A	Session K Full	Break & Posters B	Session M Full	**Common Photo**	Lunch	**Keynote talk**	Break & Posters C	Research Projects	**Dinner***
Room B	Session L Full		Session N Full					Workshops	

Thursday, June 11, 2015

	8:30 - 10:00	30'	10:30 - 12:00	20'	12:30 - 13:30	15:00/15:30 - ???
Room A	Session R Full	Break & Posters D	Session T Full	**Closing session**	Lunch	Plzen City Sightseeing Tour** & Grand Beer Tasting 15:00 Tower&Church, 15:30 Tour starting
Room B	Session S Short		Session U Short			

***OPTIONAL**

Conference Dinner: Wednesday, June 10 – buy a ticket [at a symbolic price 15 EUR] at the registration – offer limited. Place and time to be announced.

We recommend visiting (not organized tours):

- Explore Plzen City http://web.zcu.cz/plzen/
- ZOO and Botanical Garden http://www.zooplzen.cz/ (45 mins.)
- Purkmister Brewery http://www.purkmistr.cz/ (10 mins.)

**** NOT ORGANIZED – JOIN US AND PASS THE CITY CENTER**

We recommend to buy 24 hour/1 day ticket for public transport

- Techmania Science Center http://www.techmania.cz (½ day)
- Stara Sladovna – Medieval Pub – city center (40 mins.) http://www.starasladovna.cz/video/slad2.mp4
- Pilsner Urquell Brewery and Brewery Museum - http://www.prazdrojvisit.cz/en/ (30 mins.)