(1)

New Approach for Classification of Autistic vs. Typically Developing Brain Using White Matter Volumes

Mostafa Abdelrahman, Asem M. Ali, Ahmed A. Farag, Manuel Casanova, Aly A. Farag

Abstract:

Autism is a complex developmental disability, characterized by deficits in social interaction, communication skills, range of interests, and occasionally the presence of stereotyped behaviors. Several studies show that changes in brain weight and volume over aging follow a unique trajectory in those affected by the condition (Redcay E, Courchesne E. When is the brain enlarged in autism? A meta-analysis of all brain size reports. Biol Psychiatry 58(1):1-9, 2005). In this work, we develop a robust technique for evaluating the volume of white matter (WM), and use it as the main classification criteria. We perform MRI-based analysis on the brains of 14 autistic and 28 control subjects, male and female between aged 7 to 38 years. The proposed framework consists of several stages. First the entire T1-weighted MRI scans are filtered out from noise using anisotropic diffusion filter. Then, the white matter (WM) is segmented from the skull. The segmentation framework is the search for maximum-a-posterior configurations in a Markov Gibbs Random Field (MGRF) model. After that, a 3D mesh is generated from the segmented WM. Finally, the volume of the 3D mesh is computed using a new algorithm. The experiments show accurate classification results of the proposed framework.

Keywords:

Autism, white matter, MGRF-based segmentation

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(2)

A passive stereo system for 3D human face reconstruction and recognition at a distance

Mostafa Abdelrahman, Asem M. Ali, Shireen Y. Elhabian, Ham Rara, Aly A. Farag

Abstract:

In this paper, we propose a front-end framework for 3D human face reconstruction and recognition at a distance. A stereo acquisition system is built and deployed to capture stereo pairs of subjects at different distances. Three main issues are addressed to achieve accurate face reconstruction, which leads to good recognition; Different illumination conditions between the stereo pair due to larger baseline and further distances, where a fast similarity measure based on normalized cross correlation is shown to tackle such problem. Due to the non-convexity nature of a human face, concave regions introduce occluded regions where cubic Splines are used to estimate the disparity. Disparity discontinuities are introduced due to the sparse nature of stereo reconstruction, where surface fitting is performed at prominent facial points. We present our database of 99 subjects at different ranges where reconstruction and recognition results are presented.

Keywords:

Face recognition, 3d reconstruction

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(3)

Solving geometric co-registration problem of multi-spectral remote sensing imagery using SIFT-based features toward precise change detection

Mostafa Abdelrahman, Asem M. Ali, Shireen Elhabian, Aly A. Farag

Abstract:

This paper proposes a robust fully automated method for geometric co-registration, and an accurate statistical based change detection technique for multi-temporal high-resolution satellite imagery. The proposed algorithm is based on four main steps: First, multi-spectral scale-invariant feature transform (M-SIFT) is used to extract a set of correspondence points in a pair, or multiple pairs, of images that are taken at different times and under different circumstances, then Random Sample Consensus (RANSAC) is used to remove the outlier set. To insure an accurate matching, uniqueness constrain in the correspondence is assumed. Second, the resulting inliers matched points is used to register the given images. Third, changes in registered images are identified using statistical analysis of image differences. Finally, Markov-Gibbs Random Field (MGRF) is used to model the spatial-contextual information contained in the resulting change mask. Experiments with generated synthetic multiband images, and LANDSAT5 Images, confirm the validity of the proposed algorithm.

Keywords:

registration, SIFT, RANSAC, MGRF

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(4)

Novel Image-Based 3D Reconstruction of the Human Jaw using Shape from Shading and Feature Descriptors.

Aly S Abdelrahim, Mostafa Abdelrahman, Hossam Abdelmunim, Aly A Farag, Mike Miller

Abstract:

In this paper, we propose a novel approach for 3D surface reconstruction of the hu- man jaw. Due to the difficulties of setting up a data acquisition system inside the mouth, we use an intra-oral camera to capture a sequence of calibrated images. These images are registered together to build a panoramic view of the jaw. We incorporate a shape from shading(SFS) algorithm that benefits from camera calibration parameters to build a 3D model from the panoramic image obtained from the previous stage. Our approach results in a 3D surface which has more fine details compared with those resulting from other lit- erature techniques. We will demonstrate different artificial jaws surfaces reconstruction to show the efficiency of our system

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(5)

Image retrieval based on content and image compression

Aly S Abdelrahim, Mostafa A Abdelrahman, Ali Mahmoud, Aly A Farag

Abstract:

Content-based image retrieval systems have become a reliable tool for many image database applications. There are several advantages of the image retrieval techniques compared to other simple retrieval approaches such as text-based retrieval techniques. This paper proposes an image retrieval technique that can be used for retrieving color images. In this paper, we propose two variations of an image abstraction technique based on signature bit strings and an appropriate similarity metric. The technique provides a compact representation of an image based on its color content and yields better retrieval effectiveness than classical techniques based on the images' global color histograms (GCHs). The proposed technique has many applications. These applications are described in details in this paper.

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(6)
Shape modeling of the corpus callosum

Ahmed Farag, Shireen Elhabian, Mostafa Abdelrahman, James Graham, Dongqing Chen, Manuel F Casanova

Abstract:

A novel approach for shape modeling of the corpus callosum (cc) is introduced where the contours of the cc are extracted by image/volume segmentation, and a Bezier curve is used to connect the vertices of the sampled contours, generating a parametric polynomial representation. These polynomials are shown to maintain the characteristics of the original cc, thus are suitable for classification of populations. The Bernstein polynomials are used in fitting the Bezier curves. The coefficients of the Bernstein polynomials are shown to capture the geometric features of the cc, and are able to describe deformations. We use these coefficients, in conjunction with the Fourier Descriptors and other features, to discriminate between autistic and normal brains. The approach is tested on T1-weighted MRI scans of 16 normal and 22 autistic subjects and shows its ability to provide perfect classification, suggesting that the approach is worth investigating on a larger population with the hope of providing early identification and intervention of autism using neuroimaging.

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