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This is to certify that

Mahdi Saadatmand Tarzjan

Had a Poster Presentation Entitled:

"Investigating Gray-Matter Volume Abnormalities in Autism Spectrum Disorder"

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Prof. Mohammad Taghi Joghataie
Chairman

Dr. Ali Yoonessi
Basic Scientific Secretary

Dr. Mohammad Ghadiri
Clinical Scientific Secretary

مهدی سعادتمند طرزجان

Abstract

Title: Investigating Gray-Matter Volume Abnormalities in Autism Spectrum Disorder

Presentation offer: Oral

Subject: Neurodevelopmental Disorder (ADHD, Autism, Learning Disorders)

Others:

Presenter Author:

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Introduction: Autism is a psychic disorder which occurs in early years of life and causes various individual and social problems. The main cause of the disease is not determined yet. There is no absolute diagnosis and treatment/cure. Autism can be diagnosed based on the clinical and behavioral evaluation which is a time-consuming method. Besides, this method is not accurate for younger children because of various social skills and language developments. Experiments show that diagnosis for these children is difficult since they do not cooperate with experts in behavioral tests. Recently, some efforts have been performed to diagnose autism based on processing of magnetic resonance images of the brain. Obviously, in order to study the anatomical variations, the first step is the volumetric analysis of different regions of the brain. In this research, we measure the volume of different anatomical regions of the brain in T1-weighted magnetic resonance (MR) images.

Methods: First, we propose two new algorithms for registration of brain MR-images with the digital atlas ICBM152 by subsequently using both the rigid (affine) and non-rigid transformations. Then, the labeled digital atlas MNI-AAL (made in the same coordinates system of ICBM152) is employed to measure the volumes of 116 different regions of the brain gray-matter in every MR image. Finally, the volume variations of different gray-matter regions are studied within the autism category compared to the normal cases. In this research, we take advantage of 11 normal and 17 autism MR-images provided by the database ABIDE of the LONI image data archive (LONI IDA). All patients were between the ages of 7 and 8 years.

Results: The proposed rigid and non-rigid registration algorithms (abbreviated to RRA and NRRA, respectively) provided significantly superior performance compared to a number of well-known counterpart algorithms in terms of both the average cross-correlation coefficient (CCC) and CPU time. In more detail, RRA provided the average CCC of 0.83 in the autism category which is considerably better than that of the Powell method (with the average CCC of 0.68) implemented in the well-known frequently-used SPM toolbox. Additionally, the former (with the average CPU time of 93 seconds) converged 2.8 times faster than the later. Furthermore, NRRA also provided enhanced solution quality (with the average CCC of 0.88) compared to the corresponding algorithm of SPM developed based on the DCT coefficients model (with the average CCC of 0.83). Finally, experimental results demonstrated that with the significance level of 5%, the gray matter volumes of the regions left posterior cingulate gyrus, right calacarine, left lingual gyrus, right lingual gyrus, and left precuneus in the autism category, were larger than the corresponding areas in the normal category.

Conclusion: In this research two new registration algorithms based on rigid and non-rigid transformations were proposed. They were utilized for alignment and registration of the brain MR images for computing the volume of different gray-matter regions. Experimental results demonstrated statistically meaningful growth of gray-matter volume within some regions of autism brains compared to normal cases.

Keywords: Autism Spectrum Disorder (ASD); Magnetic Resonance Imaging (MRI); Brain Volume Measurement; Image Registration; ICBM152; MNI AAL

Investigating Gray-Matter Volume Abnormalities in Autism Spectrum Disorder

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