II Jornada en TIC i Salut

Trobada catalanofrancesa per a grups de recerca, empreses i centres tecnològics i assistencials

Per tal de participar en l'apartat B2B caldrà enviar la fitxa implementada, abans del **8 d'abril** a: info.ticisalut@parcudg.com

GRUP UNIVERSITARI/ CENTRE DE RECERCA/ EMPRESA: Barcelona Perceptual Computing Lab

NOM D'ENTITAT: Computer Vision Center of Barcelona

FORMAT DE PRESENTACIÓ (pòster/ *Demos):pòster

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PROPOSTA A PRESENTAR (Títol del Projecte):
"Brain Caudate Nucleus Segmentation using Graph Cuts"

ÀREA TEMÀTICA (Qualitat de vida i autonomia personal/ Innovació en la pràctica assistencial/ Les TIC al servei del ciutadà i la coresponsabilització en la seva salut):
Innovació en la pràctica assistencial

*NECESSITATS TÈCNIQUES I D'ESPAI:

ABSTRACT DEL PROJECTE (Extensió màxima 3 pàgines)

Models of attention-deficit/hyperactivity disorder (ADHD) classically emphasize the relevance of executive processes and, recently, reward circuits. The neural bases of reward processes have barely been explored in relation to this disorder, in contrast to extensive neuroimaging studies that examine executive functions in patients with ADHD. Carmona et al. were pioneer in analyzing the volume of the ventral striatum, a key region for reward processes in ADHD children [1]. They used a manual region-of-interest approach to examine whether there were volumetric differences in the ventral striatum of ADHD children. Forty-two children/adolescents with ADHD (ages 6–18), and 42 healthy control subjects matched on age, gender, and handedness were selected for the study. The ADHD children presented significant reductions in both right and left ventro-striatal. In addition, they found that the volume of the right ventral striatum negatively correlated with maternal ratings of hyperactivity/impulsivity.

This study provided neuroanatomical evidence of alterations in the ventral striatum of ADHD children. These findings coincided with previous explicative models as well as with several reports in behavioral and functional neuroimaging studies. Furthermore, the negative correlations observed strongly uphold the relation between the ventral striatum and symptoms of hyperactivity/impulsivity.

This previous work was based in a manual segmentation of the MRI regions-of-interest, resulting in a low procedure, clinically tiring. In order to accelerate the analysis and make the procedure feasible for large amounts of data, an automatic segmentation approach would be appropriate.

Several effort have been performed for segmenting different structures of the brain in Magnetic Resonance Images (MRI), as can be seen in results presented in the challenge Caudate Segmentation Evaluation 2007 [4]. In this competition, different algorithms to segment the caudate nucleaus from brain MRI scans were compared. Atlas-based segmentation is a powerful generic technique for automatic delineation of structures in volumetric images. Several studies have shown that multi atlas segmentation methods outperform schemes that use only a single atlas, but running multiple registrations on volumetric data is time-consuming and a large number of atlases may not be required to achieve good segmentation performance and may even deteriorate the results. Two generally applicable multi atlas segmentation methods, AMAS and ALMAS were presented in [5] including the automatic decision to select the most appropriate atlases for a target image and stop registering atlases when no further improvement is expected. In [6], an interesting comparative of two state-of-the-art atlas-based segmentation algorithms was presented.

In this work, we exploit the Graph Cut (GC) theory to obtain a globally optimal segmentation of the caudate structure in MRI. The GC algorithm has been used in many computer vision problems and, in particular, it can be applied to binary-segmentation of images, obtaining a solution which corresponds to the global minimum of an energy function. The goodness of the solution depends on the suitability of the energy terms and their reliable computation. For this task, GC technique [7, 8] combines local and contextual image information analysis by modeling foreground and background properties and relations between neighboring pixels. We propose a novel energy function appropriate to segment the caudate nucleaus from brain MRI scans. Contrary to classical GC techniques based on pixel intensity value, our unary pixel term is defined as the confidence of the output of a binary classifier. In particular, we define the pixel description as a correlogram structure in order to capture contextual intensity relations at the surroundings of the analyzed pixel. Moreover, in the case of the boundary term, a multi-scale edge map is proposed in order to obtain a more precise computation of artifacts boundaries and improve boundary term representation.

Preliminary results on a public Challenge data set and a new MRI data set from Hospital del Mar show accuracy segmentation and better performance than classical approaches.

References:

Medical references:

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[3] Susana Carmona Cañabate: **Neuroanatomy of attention deficit hiperactivity disorder: voxel-based morphometry and region of interest approaches**. PhD Thesis.

Thecnical references:

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