

AUTOMATIC ADHD DIAGNOSTIC TEST BASED ON SEGMENTATION OF HEAD AND BODY OF THE CAUDATE NUCLEUS

ADHD: Attention deficit hyperactivity disorder

Attention Deficit Hyperactivity Disorder (ADHD) is a developmental disorder characterized by inattentiveness, motor hyperactivity and impulsiveness, which represents the most prevalent psychiatric disorder in childhood. Studies on volumetric brain Magnetic Resonance Imaging (MRI) show neuroanatomical abnormalities in pediatric ADHD [1]. The diminished right caudate volume is one of the most replicated findings among ADHD samples in morphometric MRI studies [2]. Here is presented an automatic diagnostic methodology based on this abnormality.



Impulsivity

Inattention

Hyperactivity

1. METHOD

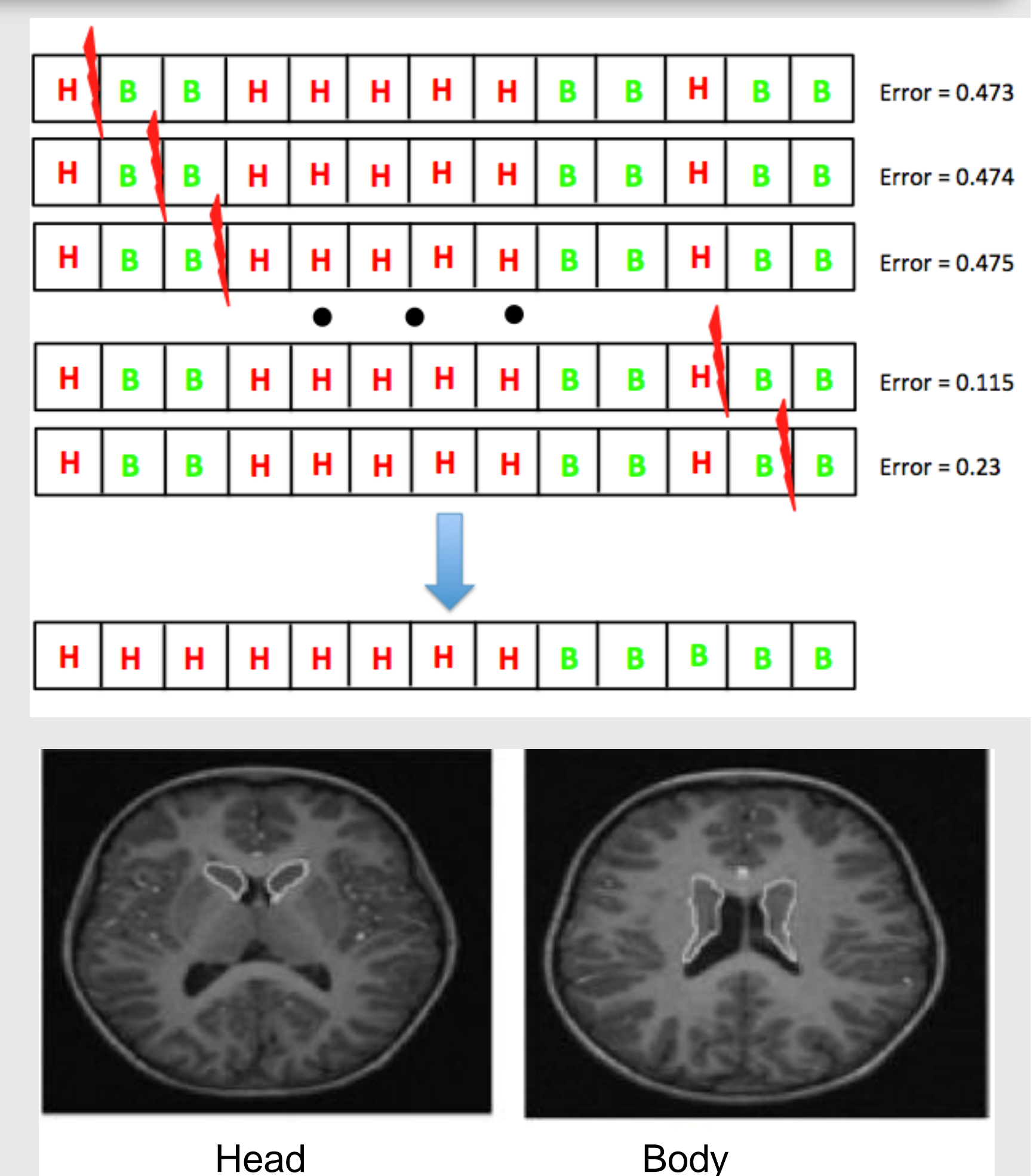
External caudate segmentation: is performed using the recently proposed **CaudateCut** segmentation algorithm [3] especially conceived for the caudate segmentation.

Internal Segmentation:
 Head and body separation.

Feature extraction and
 SVM Classification

Decision Stumps

Decision



2. Diagnostic Test

Based on [4], the diagnosis is based on a ratio between right caudate body volume (rCBV) and the bilateral caudate body volume (bCBV), $rCBV/bCBV$.

Receiver Operating Characteristic (ROC) curve analysis.

Optimal Cut-Off Value (OCOV) is estimated as the optimal ratio for which the specificity is greater or equal than a threshold Th_{spec} .

Apply OCOV to determine whether an MRI volume correspond to control or ADHD patient.

Results

Internal Segmentation:

Accuracy	Sensitivity	Specificity
92.05%	92.27%	92.50%

Diagnostic Test:

Sensitivity	Specificity	OCOV
48.72%	84.62%	0.4828

Conclusion

References

- [1] S. Carmona, O. Vilarroya, A. Bielsa et al., "Global and regional gray matter reductions in ADHD: A voxel-based morphometric study," *Neuroscience Letters*, vol. 389, no. 2, pp. 88–93, 2005.
- [2] V. Trèmols, A. Bielsa et al., "Differential abnormalities of the head and body of the caudate nucleus in attention deficit-hyperactivity disorder," *Psychiatric Research*, vol. 163, no. 3, pp. 270–278, 2008.
- [3] L. Igual, J. C. Soliva, A. Hernandez-Vela, S. Escalera, X. Jimenez, O. Vilarroya, and P. Radeva, "A fully-automatic caudate nucleus segmentation of brain MRI: Application in pediatric attention-deficit/hyperactivity disorder volumetric analysis," *BioMedical Engineering Online*, In press, 2012.
- [4] J. C. Soliva, J. Fauquet, A. Bielsa, and et al., "Quantitative MRI analysis of caudate abnormalities in pediatric ADHD: Proposal for a diagnostic test," *Psychiatry Research: Neuroimaging*, vol. 182, no. 3, pp. 238–243, 2010.