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Fuzzy logic applied to the prediction of Attention Deficit Hyperactivity Disorder based on alterations in brain structures

The brain is the most complex organ of the human body, capable of making thousands of connections and controlling fundamental functions of the body. The Diagnostic and Statistical Manual of Mental Disorders (DSM) brings together the definition and classification of different mental disorders, including Attention Deficit Hyperactivity Disorder (ADHD). Although specific causes of the disorder have not been identified, there is evidence of anatomical differences in the brains of people with ADHD compared to those without the disorder. The goal of this scientific research was to analyze how different structural changes in the brain can contribute to the manifestation of ADHD For this, a Fuzzy Rule-Based System (FRBS) was built with input variables White Matter, Cerebral Cortex, Caudate Nucleus, and Total Brain Volume, all of them characterized with the linguistic terms appropriate, partially appropriate, and slightly appropriate. The output variable considered was the Structural Index, classified into significant variation, moderate variation, and low variation. The inference method used was Mamdani's, and defuzzification was carried out using the Center of Gravity method. Simulations of clinical scenarios of hypothetical patients were implemented in MatLab software and the results achieved show that the fuzzy model is capable of providing relevant information about ADHD diagnosis. The next steps in the research involve also considering functional variables, in a second model and combining both models. It should be emphasized that mathematics and fuzzy logic are suitable tools to assist in modeling real phenomena, including in medicine, and can contribute to decision-making in complex situations.