A Machine Learning-Based Analysis of Game Data for Attention Deficit Hyperactivity Disorder Assessment

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Objective: Attention deficit hyperactivity disorder (ADHD) is found in 9.5 percent of the U.S. population and poses lifelong challenges. Current diagnostic approaches rely on evaluation forms completed by teachers and/or parents, although they are not specifically trained to recognize cognitive disorders. The most accurate diagnosis is by a psychiatrist, often only available to children with severe symptoms. Development of a tool that is engaging and objective and aids medical providers is needed in the diagnosis of ADHD. The goal of this research is to work toward the development of such a tool.

Materials and Methods: The proposed approach takes advantage of two trends: The rapid adoption of tangible user interface devices and the popularity of interactive videogames. CogCubed Inc. (Minneapolis, MN) has created “Groundskeeper,” a game on the Sifteo Cubes (Sifteo, Inc., San Francisco, CA) game system with elements that exercise skills affected by ADHD. “Groundskeeper” was evaluated for 52 patients, with and without ADHD. Gameplay data were mathematically transformed into ADHD-indicative feature variables and subjected to machine learning algorithms to develop diagnostic models to aid psychiatric clinical assessments of ADHD. The effectiveness of the developed model was evaluated against the diagnostic impressions of two licensed child/adolescent psychiatrists using semistructured interviews.

Results: Our predictive algorithms were highly accurate in correctly predicting diagnoses based on gameplay of “Groundskeeper.” The F-measure, a measure of diagnosis accuracy, from the predictive models gave values as follows: ADHD, inattentive type, 78 percent ($P>0.05$); ADHD, combined type, 75 percent ($P<0.05$); anxiety disorders, 71%; and depressive disorders, 76%.

Conclusions: This represents a promising new approach to screening tools for ADHD.