Quantum Computing: Evaluating Potential Quantification of Projective Psychological Test Scoring

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ABSTRACT

This work is focused on providing emerging technology to respond to the long-recognized need to rapidly and consistently quantify the analyses of a body of psychological tests that are otherwise ostensibly subjective. That need is driven by the increasingly distressing news of the upsurge of self-destructive behaviors: substance abuse, suicide, violent attacks, PTSD symptoms, *etc*. and the need for better early recognition and intervention. The paper reviews one of the important disciplines in psychometrics, projective tests, *e.g*. the Thematic Apperception Test, the Rorschach Test, the Draw-a-Person test. The issues militating against the more widespread use of those instruments are discussed. Three of the most debilitating characteristics of the tests are: high personnel costs of evaluation, lack of consistency in evaluations and imprecise quantification of the results. The paper sets forth emerging technologies that can putatively address all of these issues: deep learning, quantum computing, and virtual conversations with interactive computer generated humans. Advances in all of these fields are noted and their applicability to the issues at hand is discussed. The authors present their position that the use of Natural Language Processing techniques, enabled and enhanced by the emerging technologies referenced above now provide a more efficacious way to administer and benefit from projective tests. This would allow neural net training to isolate diagnostic insights. Further, they advance the assertion that such tests will open up entirely new areas of investigation and reveal new areas of insight that have heretofore escaped the attention of mental health professionals. The extensibility of these instruments into other uses is considered and the adaptability into the readers' disciplines is expressed. One of the areas being investigated is the use of these techniques in the recruitment and placement evaluations in police forces. The paper concludes with a short analysis of anticipated progress in each technology.

ABOUT THE AUTHORS

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Dan M. Davis is now a consultant for the University of Southern California, focusing on large-scale distributed DoD training, education and avatar mentors. Pre-retirement, he was the Director of USC's JESPP project for JFCOM for a decade. As the Assistant Director of the Center for Advanced Computing Research at Caltech, he managed Synthetic Forces Express, bringing HPC to DoD simulations. Prior experience includes serving as a Director at the Maui High Performance Computing Center and as a Software Engineer at the Jet Propulsion Laboratory and Martin Marietta. He has served as the Chairman of the Coalition of Academic Supercomputing Centers and has taught at the undergraduate and graduate levels. As early as 1971, Dan was writing programs in FORTRAN on one of Seymour Cray's CDC 6500's. He saw duty in Vietnam as a USMC Cryptologist and retired as a Commander, Cryptologic Specialty, U.S.N.R. He received B.A. and J.D. degrees from the University of Colorado in Boulder.

Sanad Z. Rizvi was a visiting Research Assistant at the Institute for Creative Technologies of the University of Southern California. His interests are in Machine Learning Research and its applications on the real world. Given his Computer Science background, he has accumulated good experience in software development through various research activities and programming projects. He is facile in Python and has made open source contributions to that language. Currently, he is focusing on Machine Learning/Deep Learning related research opportunities. He earned a B.Tech. degree in Computer Science and Engineering from the National Institute of Technology, Mysore, India.

Kenneth Shaw was a visiting Research Assistant at the Institute for Creative Technologies of the University of Southern California. He was selected to participate in the National Science Foundation's Research Experiences for Undergraduates in 2018. His major interests in research include creating life-like interactive experiences using artifi-

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Ke-Thia Yao, Ph.D. is a Project Leader and Research Scientist in the Computational Systems and Technology Division of the University of Southern California (USC) Information Sciences Institute (ISI). His primary research interest is in understanding large complex systems and data sets. He teaches data management classes at USC's Viterbi School of Engineering. He is part of the team investigating uses for USC's 2,000 Qubit Quantum Annealer. Dr, Yao was one of the leads on the JESPP project where he analyzed the computational and behavioral properties of large-scale simulations. That project had the goal of supporting very large-scale distributed military simulation involving millions of virtual and constructive entities. He received his B.S. degree in EECS from UC Berkeley, and his M.S. and Ph.D. degrees in Computer Science from Rutgers University.

Benjamin Nye, Ph.D. is the Principal Investigator on this MentorPal Project and the Director of Learning Science at the University of Southern California, Institute of Creative Technologies (USC-ICT). Ben's research tries to remove barriers development and adoption of adaptive and interactive learning technology so that they can reach larger numbers of learners. Dr. Nye's research has been recognized for excellence in intelligent tutoring systems (1rst Place ONR ITS STEM Grand Challenge; Nye, Windsor, et al., 2015; Nye et al., 2014), cognitive agents (BRIMS 2012 best paper; Nye & Silverman, 2013; Nye, 2012), and realistic behavior in training simulations (Federal Virtual Worlds Challenge; Silverman et al., 2012). His research is on scalable learning technologies (Nye et al., 2014) and design principles that promote learning (Nye, Graesser, & Hu, 2014; Nye, 2014; Nye, Morrison, & Samei, 2015). This research has led to 20 peer-reviewed papers, 11 book chapters, and 5 open-source projects. Ben is the membership chair for the International of Artificial Intelligence in Education (IAIED) Society and holds memberships in Educational Data Mining Society (EDM), and Association for the Advancement of Artificial Intelligence (AAAI) He also co-chairs the FLAIRS Learning Technologies track (2015-2017).