Decision Models of Medical Signal and Imaging Data to Improve Medical Diagnoses

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Abstract: The overarching goal of our research is to develop new data analytics techniques based on applied optimization and machine learning. The main driving application of our techniques is to assist physicians in recognizing abnormality patterns (and/or patterns of interest) in medical signal and imaging data. The main focus of our work is on feature selection, which has become an emerging problem in machine learning and optimization. Searching for the optimal set of features in decision models is computationally challenging, and it also needs to avoid model overfitting. While the main objective of most decision models is to provide an accurate decision or prediction outcome, physical/physiological interpretation of such models are extremely important in medical domain. Our group has developed a host of feature selection techniques that can improve the accuracy and interpretability of our medical decision models. In this talk, I will discuss a few real life medical applications of our techniques, which span from prediction of neural response to visual stimuli from functional magnetic resonance imaging (fMRI), diagnostic classification of attention-deficit/hyperactivity disorder from structural (MRI), and treatment planning of lung cancer using PET/CT. If time permits, I will give an overview of other research projects undertaken in our group.

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Bio: *Wanpracha Art Chaovalitwongse* is Professor in the Departments of Industrial & Systems Engineering, Radiology (joint), and Bioengineering (adjunct) at the University of Washington, Seattle (UW). He also serves as Associate Director of the Integrated Brain Imaging Center at UW Medical Center. Before moving to Seattle, he worked as Visiting Associate Professor in the Department of Operations Research & Financial Engineering at Princeton University. From 2005 to 2011, he was on the faculty in the Department of Industrial & Systems Engineering at Rutgers University. Before working in academia, he worked at the Corporate Strategic Research, ExxonMobil Research & Engineering, where he managed research in developing efficient mathematical models and novel statistical data analyses for upstream oil exploration and downstream business operations in multi-continent oil transportation. His research group conducts basic computational

science, applied, and translational research at the interface of engineering, medicine, and other emerging disciplines. His work thus far has focused on (a) computational neuroscience, (b) computational biology, and (c) logistics optimization. He holds three patents of novel optimization techniques adopted in the development of seizure prediction system. His academic honors include 2003 Excellence in Research from the University of Florida, 2006 NSF CAREER Award, 2007 Notable Alumni of King Mongut's Institute Technology at Ladkrabang, 2004 & 2008 (2-times winner) William Pierskalla Best Paper Award by the Institute for Operations Research and the Management Sciences (INFORMS), 2009 Outstanding Service Award by the Association of Thai Professionals in America and Canada, 2010 Rutgers Presidential Fellowship for Teaching Excellence, 2014 Finalist of the UW College of Engineering Faculty Innovator Award, and several other best student paper awards with his PhD students.