Explainable Artificial Intelligence in Precision Medicine

Modern machine learning (ML) models can accurately predict patient progress and outcomes. However, they do not explain why selected features make sense or why a particular prediction was made. For example, a model may predict that a patient will get chronic kidney disease, which can lead to kidney failure. The lack of *explanations* about which features drove the prediction – e.g., high systolic blood pressure, high BMI, or others – hinders medical professionals in making diagnoses and decisions on appropriate clinical actions. I will briefly describe my group's efforts to develop interpretable ML techniques for varied medical applications, including treating cancer based on a patient's own molecular profile, identifying therapeutic targets for Alzheimer's, predicting kidney diseases, preventing complications during surgery, enabling pre-hospital diagnoses for trauma patients, and improving our understanding of pan-cancer biology and genome biology. My talk will focus in greater detail on: MERGE, which uses ML to target treatment of acute myeloid leukemia, published in *Nature Communications* (Jan 2018); our explainable artificial intelligence system, Prescience, for preventing hypoxemia in patients under anesthesia, recently featured on the *cover of Nature Biomedical Engineering* (Oct 2018); and SHAP, our general ML framework on model interpretability, published as a full oral presentation at *Neural Information Processing Systems* (Dec 2017; cited 150).

Short bio

Prof. Su-In Lee is an Associate Professor in the Paul G. Allen School of Computer Science & Engineering and an Adjunct Associate Professor in the Departments of Genome Sciences, Electrical Engineering, and Biomedical Informatics and Medical Education at the University of Washington. She completed her PhD in 2009 at Stanford University with Prof. Daphne Koller (Stanford Artificial Intelligence Laboratory). Before joining the UW in 2010, Lee was a visiting professor in the Computational Biology Department at Carnegie Mellon University. She has received the National Science Foundation CAREER Award and been named an American Cancer Society Research Scholar. She has received numerous generous grants from the National Institutes of Health, the National Science Foundation, and the American Cancer Society. Lee is currently the PI for the following active grants: NIH/NIA R01, NIH/NLM R21, NIH/NIGMS R35, NSF/BIO INNOVATION, NSF/BIO CAREER, and ACS Research Scholar.
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