Lecture 6.2 (11:40-12:05)

AI-Enhanced Integration of Genetic and Medical Imaging Data for Risk Assessment of Type 2 Diabetes

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Type 2 diabetes (T2D) is a global public health concern due to its increasing prevalence. Risk assessment and early detection of T2D are vital in improving individuals' health, reducing the burden on national health insurance, and enhancing well-being. This study leverages artificial intelligence, specifically eXtreme Gradient Boosting (XGBoost), to develop predictive models for T2D based on genetic and medical imaging data. The models aim to establish a prediction model and identify high-risk subgroups for T2D within a cohort of 68,769 Taiwan Biobank participants. The approach integrates the Polygenic Risk Score (PRS) and Multi-image Risk Score (MRS) with demographic factors and environmental exposures to assess T2D risk. The model's performance is evaluated using the Area Under the Receiver Operating Curve (AUC). Results demonstrate that genetic information alone is insufficient for accurate T2D prediction (AUC = 0.73), whereas medical imaging data, including abdominal ultrasonography, vertebral artery ultrasonography, bone density scan, and electrocardiography, significantly improves prediction accuracy (AUC = 0.89). The best-performing model integrates genetic, medical imaging, and demographic variables (AUC = 0.94), successfully identifying subgroups at high risk of developing T2D. The study also presents an online risk assessment website for T2D. In summary, this research represents the first integration of whole-genome and medical imaging data for T2D risk assessment. The genetic-only model outperforms previous genetic prediction studies, and integrating genetic and medical imaging information significantly enhances AUC. By utilizing artificial intelligence to analyze genetic, medical imaging, and demographic factors, this study contributes to the early detection and precision health of T2D.

This is a joint work with Yi-Jia Huang (National Yang Ming Chiao Tung University, Taiwan) and Chun-Houh Chen (Academia Sinica, Taiwan)