Biomedical Informatics Grand Rounds
Wednesday, October 11, 2023
3:00 pm – 4:00 pm

Neuro-Symbolic Models for Time Series Analysis and Their Application to
Chronic Wound Healing

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Abstract: A chronic wound is a wound that fails to progress, and it requires special treatment to heal successfully. It is a common problem for diabetic patients (in the form of diabetic foot ulcers) since diabetes interrupts the body's natural healing process. In this talk, I will introduce how machine learning is used for monitoring the status of wound healing which becomes one critical step towards accelerating the chronic wound healing.
In particular, we developed a neuro-symbolic model for interpretable wound healing stage classification based on time series data collected from multiple sensors. Most existing time series classification models lack interpretability and are difficult to inspect. In order to obtain interpretability, our neuro-symbolic model leverage signal temporal logic and neural networks to accomplish time series classification tasks. The output of the model is interpretable as a logic formula akin to natural language, describing temporal and logical relations hidden in the data. The performance of the model is also comparable to the state-of-the-art models. In addition to wound healing, we further show that the neuro-symbolic model can be modified and applied to many other tasks, including event stream modeling (by combining with point processes) and in-hospital mortality prediction (by combining with shapelet tranform).

Educational objectives:

(1) Learning about the background of chronic wound healing and how machine learning can help

(2) Learning about the concept of neuro-symbolic models and its development

(3) Learning about the applications of event stream modeling and in-hospital mortality prediction

Bio: Tengfei Ma is an assistant professor in the Department of Biomedical Informatics, Stony Brook University. Before joining SBU in Aug 2023, he was a staff research scientist in IBM T. J. Watson Research center, where he led the AI challenge of deep learning on graphs as well as a DARPA project about wound healing. Prior to that, he obtained his Ph.D. from the University of Tokyo in 2015 and worked as a researcher in IBM Research Tokyo for one year. He got his master's degree from Peking University and his bachelor's degree from Tsinghua University. His research interests include machine learning, natural language processing and computational healthcare. In particular, his recent research is focused on deep graph learning, time series analysis and their application in the biomedical domain. He has published over 50 papers in premium AI conferences such as NeurIPS, ICLR, ICML, AAAI, KDD, EMNLP. His work FastGCN is one of the pioneering works about efficient training of graph neural networks, and it has been cited for more than 1000 times. He is also a recipient of the best paper award in ISWC 2021 research track. More details can be found in his homepage https://bmi.stonybrookmedicine.edu/people/tengfei_ma.