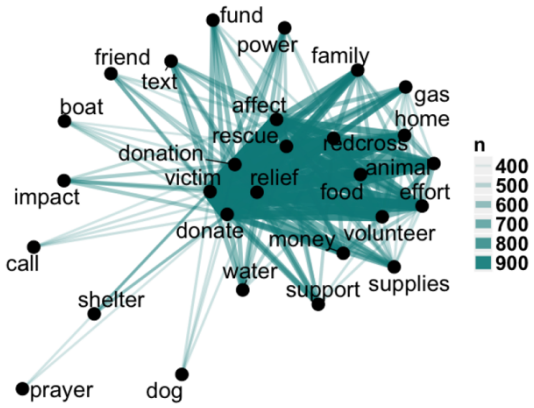
National Wind Institute

Large-scale data analysis for wind speed and hazard resilience

By: Fang Jin

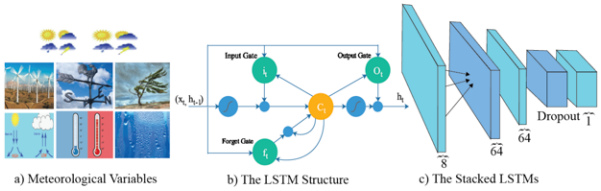
The wind is a free renewable source of energy. It has several valuable benefits (e.g., energy) in our daily lives and numerous cons (e.g., hurricane). At the National Wind Institute, we employ data science to help mitigate disasters for people who undergone hurricane events.

People during disaster events need help before, during and after disasters, though it is hard to accomplish in chaos. We built NiRec website using people's tweets (text, time, location) to predict victims' needs before, during, after disasters aiming to facilitate timely rescue and efficient supplement distribution for disaster relief organizations. We integrate spatial-temporal features extracted from social media with our classifications and forecasting algorithms to uncover people's need trends and geographical distribution in real time, which has the potential to improve the efficiency of disaster management substantially.



Word co-occurrence network with different frequency levels for Hurricane Harvey related needs.

Precisely forecasting wind speed is essential for wind power producers and grid operators. However, this task is challenging due to the stochasticity of wind speed. To accurately predict short-term wind speed under uncertainties, we design and implement neural networks. We used meteorological attributes (e.g., wind speed, wind direction, temperature, humidity, pressure, dew point, wind speed, and solar radiation) as an input to Long short-term memory (LSTM) followed by a stacked of LSTMs. The anticipation of speed wind is assessed using real data from West Texas, USA. Our proposed approach outperformed the state of the art algorithms.



Multi-variable Stacked Long-Short Term Memory Network for Wind Speed Forecasting.

Our goal is to apply cutting-edge machine learning technologies for social good. We are investigating wind and hurricanes using big data analytics, especially working on the direction of data mining, text mining, data fusions. The key objectives of the projects are to maximize the benefits of wind energy and minimize the impact of windstorms.

About the Author

Fang Jin is a faculty member in the National Wind Institute at Texas Tech University. She is an assistant professor in the Department of Computer Science at Texas Tech. Her research is in the area of machine learning, data mining, data fusion, and spatiotemporal data analysis, with a specific focus on hazard resilience.