FloodCast: Predicting Floods and Their Socioeconomic Impacts Through Deep Learning Neural Networks and Regression

Zhuang, Adrian (School: The King's School)
Zhuang, Alex (School: The King's School)

Floods are widely considered the most expensive natural disaster due to their destructive nature and severe societal repercussions. Thus, our research seeks to predict flood occurrences and quantify their socio-economic impacts. To do so, we collated the largest dataset of historical floods ever used in Australian flood research (>1200 entries) and mapped flood locations in the past two decades to hydrological flooding factors (rainfall, elevation etc.) using ArcGIS. The resulting dataset underwent unsupervised clustering to display statistical significance and was used to train a deep learning neural network with a 85-90% accuracy, allowing us to make location-specific flood predictions. Using a K-nearest-neighbours optimisation algorithm, we also determined the most relevant factors in flood prediction to assist future research. Going one step beyond existing literature on floods, this paper is also the first instance of Australian research to combine flood analysis with sociological analysis. We left-merged the floods dataset with Australian census data and performed ordinary least squares regressions, using a dummy variable to distinguish flooded & non-flooded data points. By analysing the coefficient of this dummy variable, we discovered that flooded areas experience a ~5% increase in Indigenous Australian population, hinting towards a dangerous possibility of environmental redlining. We also quantified how floods impact household income, unemployment, and migration. By making our datasets open-access and developing a publicly available flood prediction application containing our neural network model, our goal is that everybody, up to governments and down to individuals, can benefit from the results of this research.