PROJECT TITLE: Wildfire Spreading Prediction Using Graph Neural Networks

Project Supervisor: Dr Xiaoyang Wang, Department of Computer Science, University of Exeter

Project Enquiries: x.wang7@exeter.ac.uk

Project keywords: Wildfire, Remote Sensing, Machine Learning, Graph Neural Networks

Proposed start date: 3rd June (could be postponed but no later than 8th July)

Project description:

Wildfires pose significant threats to both human life and the environment. Timely prediction of their spread is crucial for effective mitigation efforts. Recently, machine learning, especially deep learning, has shown good results in predicting the spread of wildfire at a global scale. This 8-week research project aims to explore the application of Graph Neural Networks (GNNs) in predicting wildfire spread patterns. Traditional methods often fail to capture the intricate spatial dependencies inherent. GNNs, however, offer a promising approach by treating the wildfire landscape as a graph, where nodes represent geographical locations and edges denote the relationships between them. The project will involve leveraging graph-based representations to model the complex interactions among various factors influencing wildfire propagation. At the end of the project, the intern will acquire knowledge on machine learning, graph neural networks, climate prediction models and large-scale data analysis.
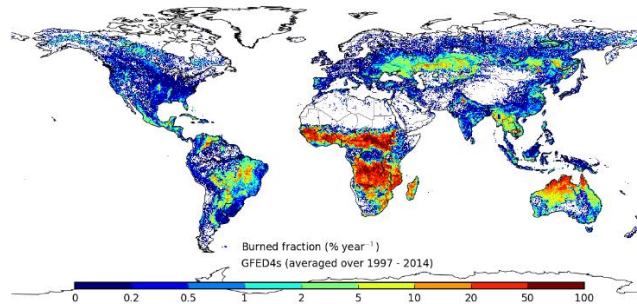

Fig. 1 Annual burned area (as percentage of the area of the grid cell), averaged over 1997-2014. (Source: Global Fire Emissions Database)

Candidate requirements:

Math and programming skills (preferably in Python)
Basic understanding of computer vision

Background reading:

1. "Next Day Wildfire Spread: A Machine Learning Data Set to Predict Wildfire Spreading from Remote-Sensing Data" https://arxiv.org/abs/2112.02447
2. "Improving prediction and assessment of global fires using multilayer neural networks" https://www.nature.com/articles/s41598-021-81233-4.pdf

Approximate Work Schedule in weeks
Week 1: Background reading.
Week 2-3: Get familiar with the dataset; build a data loader; data preprocessing.
Week 4: Build a baseline model using regression methods.
Week 5-7: Build a GNN model for wildfire prediction.
Week 8: Report writing, presentation and poster preparation.