A New Deep Learning Multi-Scale Graph Neural Network approach for river flow forecasting

Dina Theodosiadou

PhD student (1st year), University of Bath

Supervisors: Dr Andy Barnes, Dr Thomas Kjeldsen, Prof Mike Tipping

* Funded through a university studentship award (UKRI – EPSRC)

Introduction

Flood risk analysts rely on riverflow forecasts.

There is an increasing interest in coupling AI with hydrologic models.

E.g., Recent acceptable deep learning models in hydrology are LSTMs.

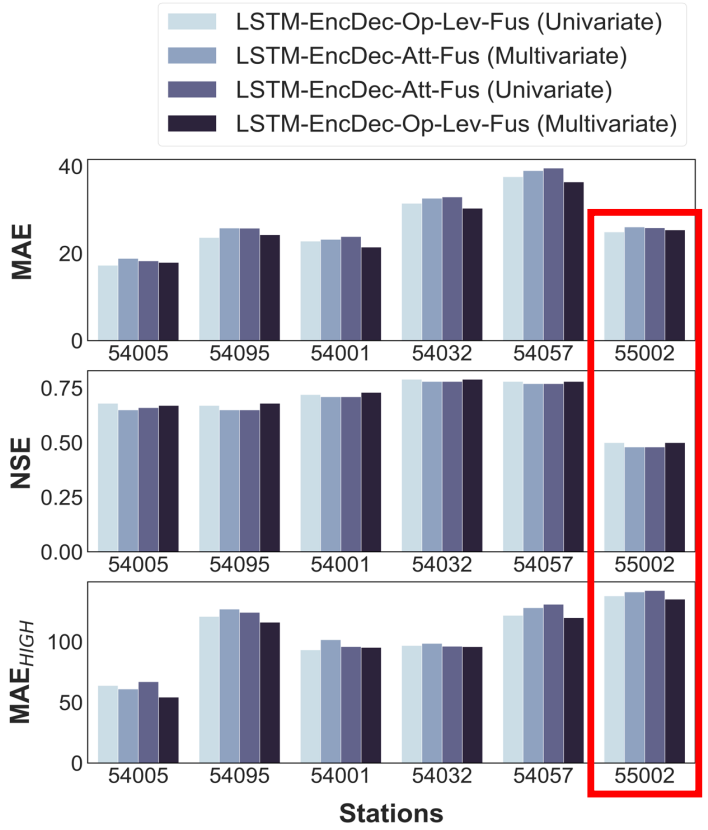
But...

My current results show **a prominent bias** on a river station **belonging to a different river**.

Do I need more balanced input data?

Or do I need to add additional context data?

Or...would river connectivity solve this issue?



At the same time…

A river is part of a “river network”

GNNs (Graph Neural Networks) are suited for problems with network structure

Does that mean I should explore a multi-scale GNN?

It is claimed that leveraging diverse sources of data is making a data-driven model more powerful

My research questions are...

Can the addition of **river station connectivity** and using a GNN model reduce the river station bias?

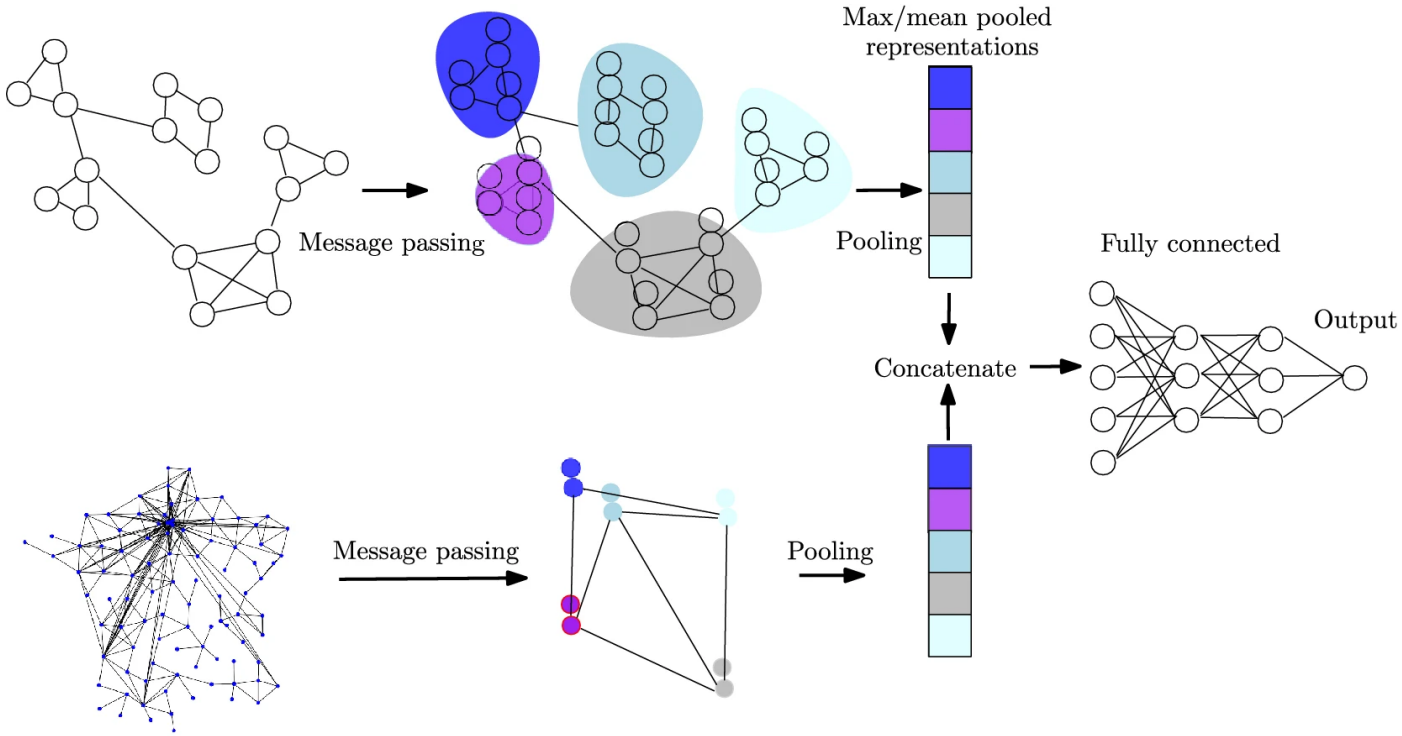
Is bias more dependent on the balanced diversity of the input data rather than the choice of a data-driven model?

Is it worth training a multi-scale GNN as opposed to a plain GNN?

Model...

Hydrometric areas (coarser scale)

River stations (finer scale)



Limitations…

Scalability to larger areas?

Redundancy of the coarser scaler and lower data quality “hurting” the predictions

Thank you! ☺

Feel free to connect with me:

LinkedIn: https://www.linkedin.com/in/dinatheodosiadou/

Email: kt918@bath.ac.uk

References: Skianis, K., Nikolentzos, G., Gallix, B. *et al.* Predicting COVID-19 positivity and hospitalization with multi-scale graph neural networks. *Sci Rep* **13**, 5235 (2023). https://doi.org/10.1038/s41598-023-31222-6