

## Linear Depth Graph Models

The role of depth in the computation of neural networks is often two fold. On one side they often have to have a certain depth which is required to gather the necessary information (ie. further back in a sequence or a node that is far away) on the other hand depth is also required to then transform the gathered information accordingly to produce the output. Unfortunately, training a deep model with lots of non-linearities, ie. it is rich in sequential non-linear depth is very hard. Modern deep learning architectures have found ways to go around this by using the infamous Transformer architecture or the recently re-introduced SSM such as Mamba.

However what about graphs? There has been recent effort to also extend these techniques to graph-structured data. In this thesis we want to specifically study how we can apply these recent techniques to get rid of non-linear sequential depth in specific graph architectures where depth would be crucial for strong algorithmic guarantees. This project is at the cutting edge of research, we are mainly looking for people with a strong motivation to work on this problem (even if the background or the knowledge about this field is not as established).

The exact scope of the project is not yet fixed and is up for discussion; we are looking for motivated students who are excited to work on the field linearized graph models

**Requirements:** Programming skills (Python, C/C++, ...) and knowledge of machine learning, linear algebra. Prior experience on working with graphs or related machine learning frameworks such as Pytorch or Pytorch geometric is an advantage.

We will have weekly meetings to address questions together, discuss progress, and think about future ideas.

### Contact

In a few short sentences, please tell us why you are interested in the project and about your coding and machine learning background (i.e., your own projects or courses).

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