CSE 881 Final Project Report

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1. Role of each team member:

- *Li Zhang*: Models exploration and coding.
- *Wenting Liu*: Final report wrap up.
- Both team members engage in problem discussions and solution seeking including debugging, finding solutions from slides, getting suggestions from TA, planning timelines etc.

2. The solutions:

Our best performance accuracy so far is 0.858871. The model that we used for it is:

- Convolutional Layer: APPNP
  - K: 5
  - alpha: 0.2
- Loss function: Cross Entropy
- optimizer: Adam
- Tuned hyperparameters:
  - loss rate: 0.01
  - weight decay: 0.001
  - num_hidden: 64
- Other techniques:
  - K-fold cross validation
  - Ensemble Methods

3. Results and Discussions:

In our project, we achieved two milestones.

- The first one involved a significant improvement in performance accuracy, increasing from 0.199093 in the second round to 0.849294 in the third round. Prior to this, we were struggling with low accuracy, and eventually discovered that the cause was a technical issue in our code - specifically, we were using the wrong mask function for evaluating the testing dataset.

Therefore, in our first two submissions, the low accuracy was mainly caused by the wrong order of predicted labels.

- The second milestone in our project was considerably more challenging than the first - namely, how to achieve an increase in accuracy greater than 1%. To accomplish this, we explored a range of models, such as GCNConv, GraphConv, SAGEConv, and APPNP, and utilized techniques such as 1) Feature Selection to avoid correlated features, 2) Grid Search Cross Validation to fine-tune hyperparameters, and 3) Ensemble Methods to get the improved results.

In the end, our performance accuracy saw a significant increase - starting at 0.176915 initially, and ultimately reaching 0.858871.

4. The learned lessons and further improvements:

4.1 The learned lessons:

- Through this project, we acquired a wealth of knowledge about Graph Neural Networks (GNN), including the fundamentals of Pytorch, PyTorch Geometric (PyG), as well as a variety of advanced neural network operators such as GNC, SAGE, Graph, APPNP, among others.
- Furthermore, we had the opportunity to apply a range of machine learning and deep learning techniques that we had learned - such as exploratory data analysis (EDA), cross-validation, hyperparameter tuning via Grid Search, as well as Ensemble methods, etc.
- We also gained valuable insights into how real-world projects operate, including how to effectively collaborate within a team, and how to seek out resources and support when facing challenges or obstacles.

In summary, this project provided us with a valuable opportunity to enhance not only our professional skills in data analysis, but also our ability to work collaboratively with others towards a common goal - an important aspect of functioning effectively as a social individual.

4.2 Further improvements:

- Attempt to use other convolutional layers available in torch_geometric.nn.
- Experiment with alternative optimizers such as SGD, Momentum, RMSprop, and so on.
- Explore opportunities for collaboration with other groups.