Application of Graph Neural Networks to Mitigate Popularity Bias in Content Recommendations

Recommender systems often overemphasize popular items, reducing diversity and limiting exposure to less popular but relevant content.

The problem

How can we leverage GNNs to address the popularity bias in content recommendations ensuring overall recommendation quality is not compromised?

The method

FairGNN – a novel framework that integrates a Pareto-optimal approach to balance recommendation accuracy with fairness and diversity.

The solution

1 Develop FairGNN through dual-branch processing and contrastive learning.
2 Apply Pareto optimization for multi-criteria balancing.

Pareto Analysis of FairGNN and Baselines

The plot shows the trade-off between Precision and Fairness, highlighting Pareto-optimal models.

The error: $E = \min_{i \in \text{Pareto}} \sqrt{(P - P_i)^2 + (F - F_i)^2}$.

1. Models with similar Precision values can significantly differ in Fairness and vice versa.

2. Achieving a balance between metrics is an indication of well convergence.
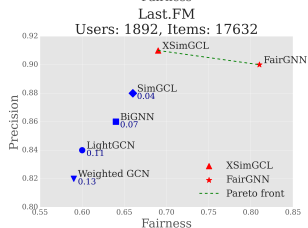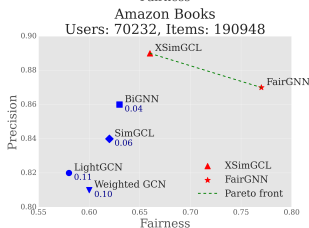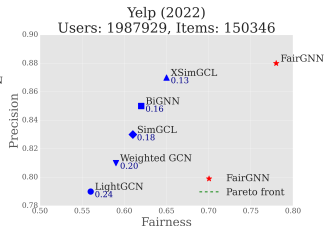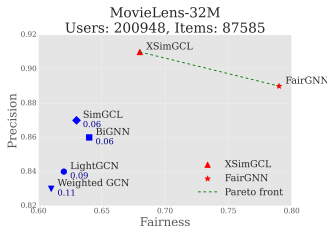
FairGNN balances accuracy and fairness, providing robust performance in mitigating popularity bias.