Supplementary Material - ReCon: Reducing Congestion in Job Recommendation using Optimal Transport

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A EXPERIMENTAL EVALUATION

A.1 Details of hyper-parameters of the eecommendation models

In this section we describe the hyper-parameters used.

For the base CNE model, we use the degree prior (for more information please see [1]) and use dot product as the distance function. We also perform hyper-parameter tuning based on validation AUC to select the hyper-parameters. For both datasets, the best embedding dimension is four and the best learning rate is 0.05. The best weight decay in AdamW optimizer for VDAB is 0.1 and for CareerBuilder is 0.01. The batch size is set to 4096 for VDAB and 2048 for CareerBuilder.

For ReCon, we only experimented with few combinations of hyper-parameters around the hyper-parameters of the base CNE model and monitored all desirability measures and congestion-related measures. For both datasets, the embedding dimension eight shows to have a good trade-off between the desirability measures and the congestion-related measures. For VDAB, we set learning rate to 0.05 and weight decay to 0.01. For CareerBuilder, we set learning rate to 0.1 and weight decay to 0.001. We used the same batch size as the base CNE model.

A.2 Baseline comparison

Here we compare the methods in terms of the desirability measures and congestion-related measures (**Q1**). Figures 1, 2, 3 and Figures 4, 5, 6 show the performance of all methods for VDAB and CareerBuilder datasets, respectively. They all compare a desirability measure (NDCG, Recall, or Hit Rate) and a congestion-related measure (Congestion, Coverage, or Gini Index). We can observe that for some selections of hyper-parameters, ReCon usually finds a good trade-off between both measures.

A.3 Hyper-parameter sensitivity analysis for λ

In this section, we analyze the performance of ReCon for different values of λ (the weight of the optimal transport in ReCon). Figure 7 shows different measures for different values of λ for both datasets. As expected, we can observe that congestion-related measures mostly improve by increasing λ, but at the cost of desirability measures.

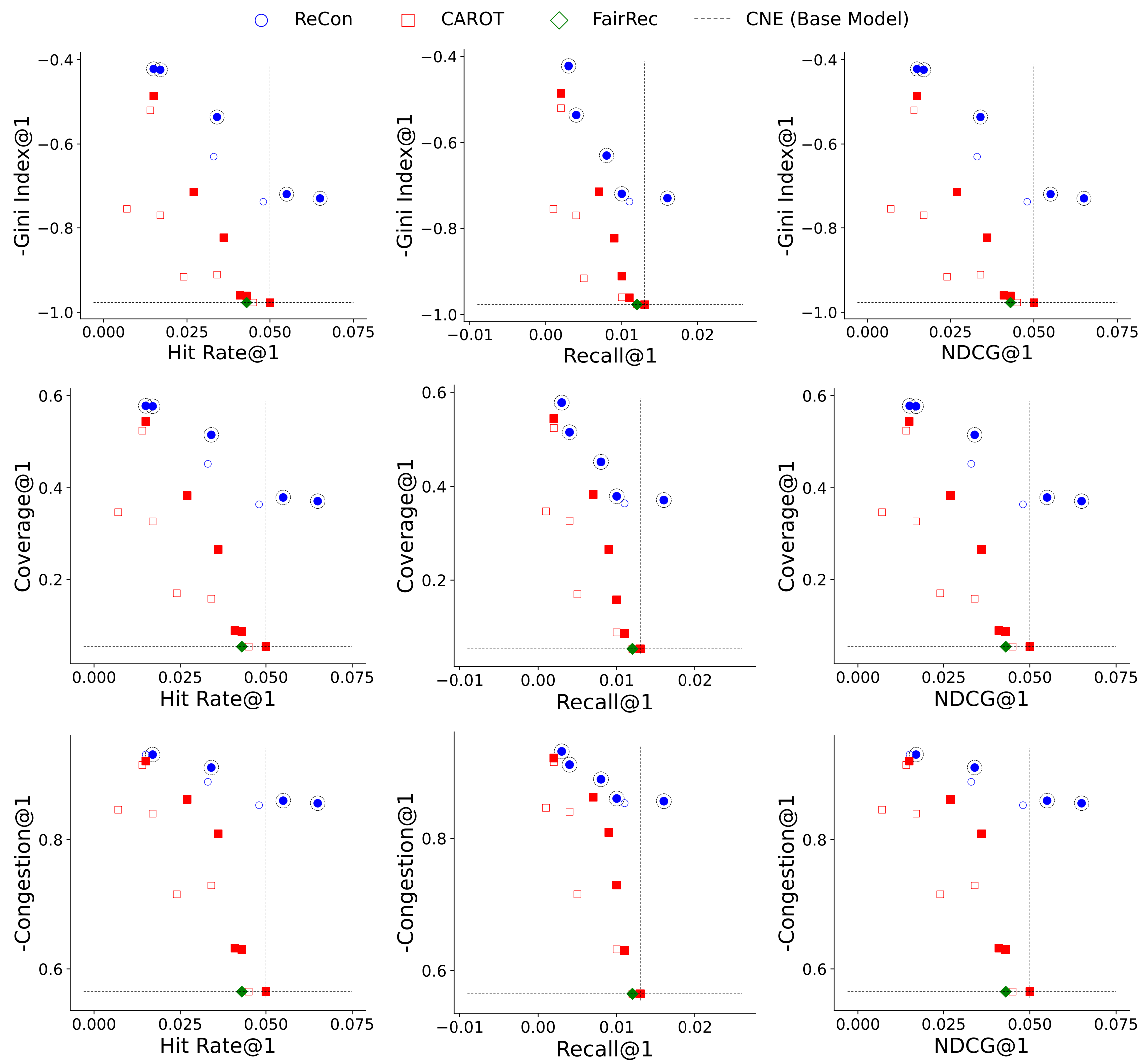

Fig. 1. Desirability versus congestion-related measures in VDAB dataset for top-1 recommendation (higher values are better). Points represent different hyper-parameter combinations. Pareto optimal points per method are filled. Pareto optimal points across methods have a circle around.

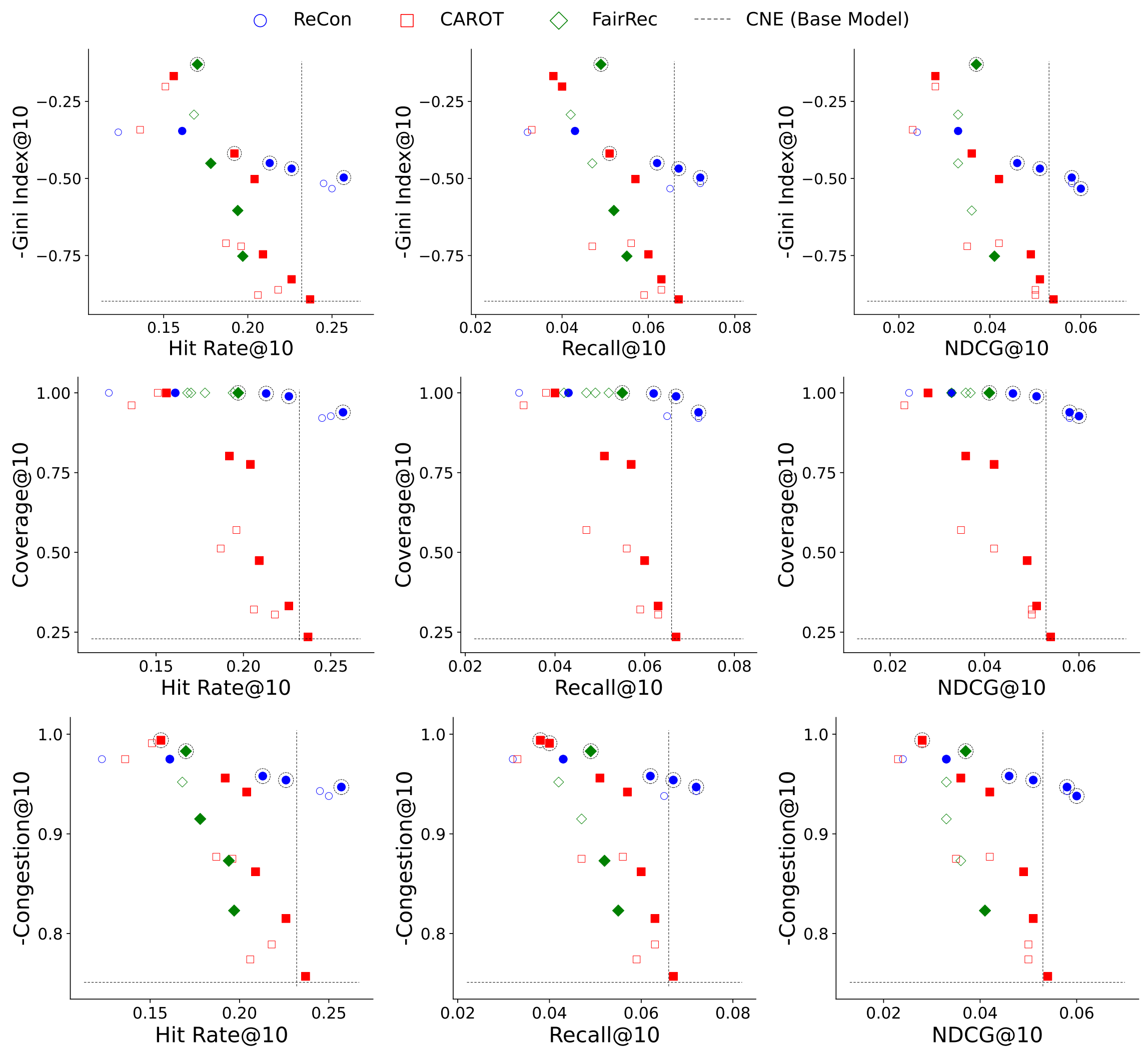

Fig. 2. Desirability versus congestion-related measures in VDAB dataset for top-10 recommendation (higher values are better). Points represent different hyper-parameter combinations. Pareto optimal points per method are filled. Pareto optimal points across methods have a circle around.

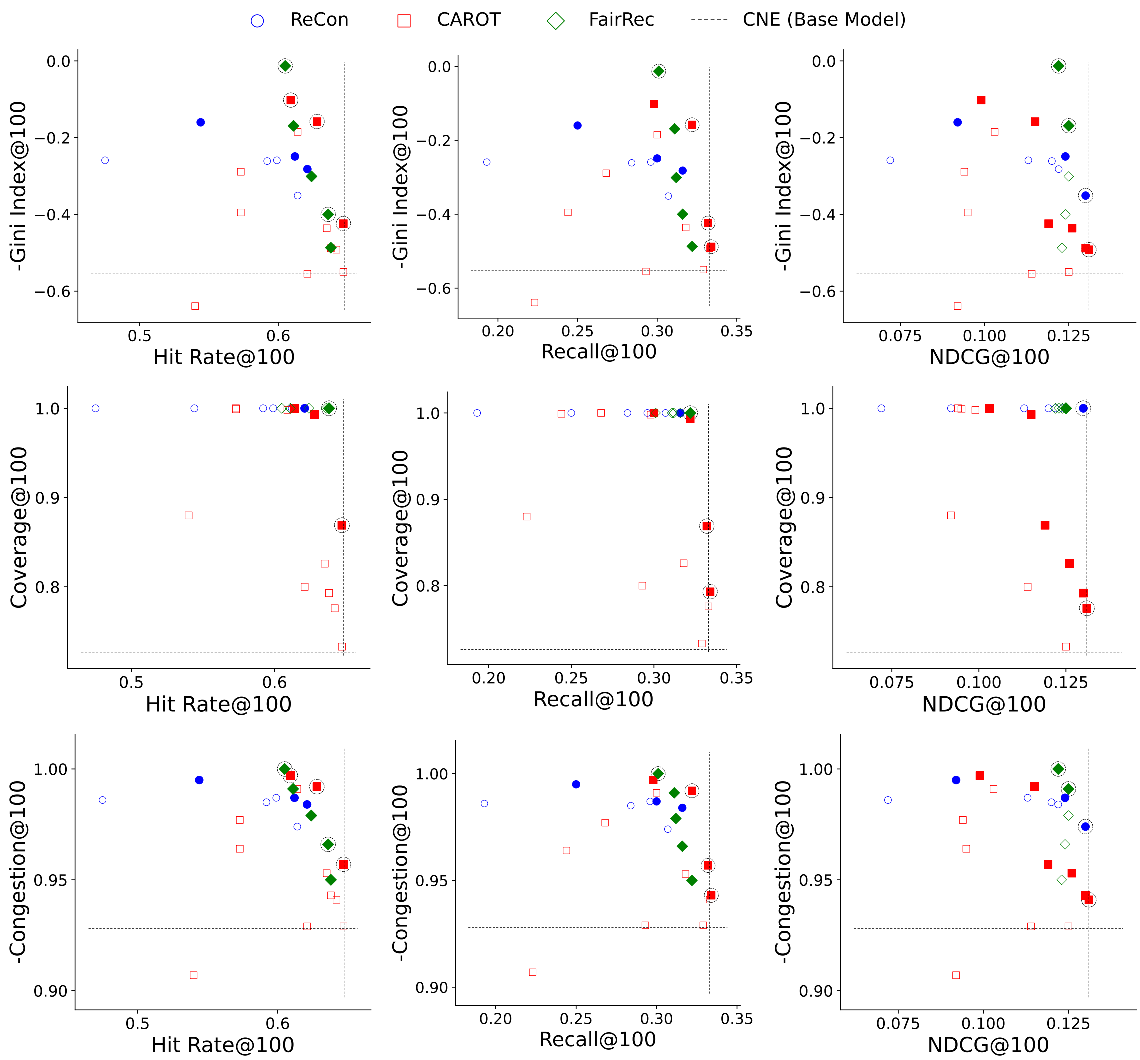

Fig. 3. Desirability versus congestion-related measures in VDAB dataset for top-100 recommendation (higher values are better). Points represent different hyper-parameter combinations. Pareto optimal points per method are filled. Pareto optimal points across methods have a circle around.

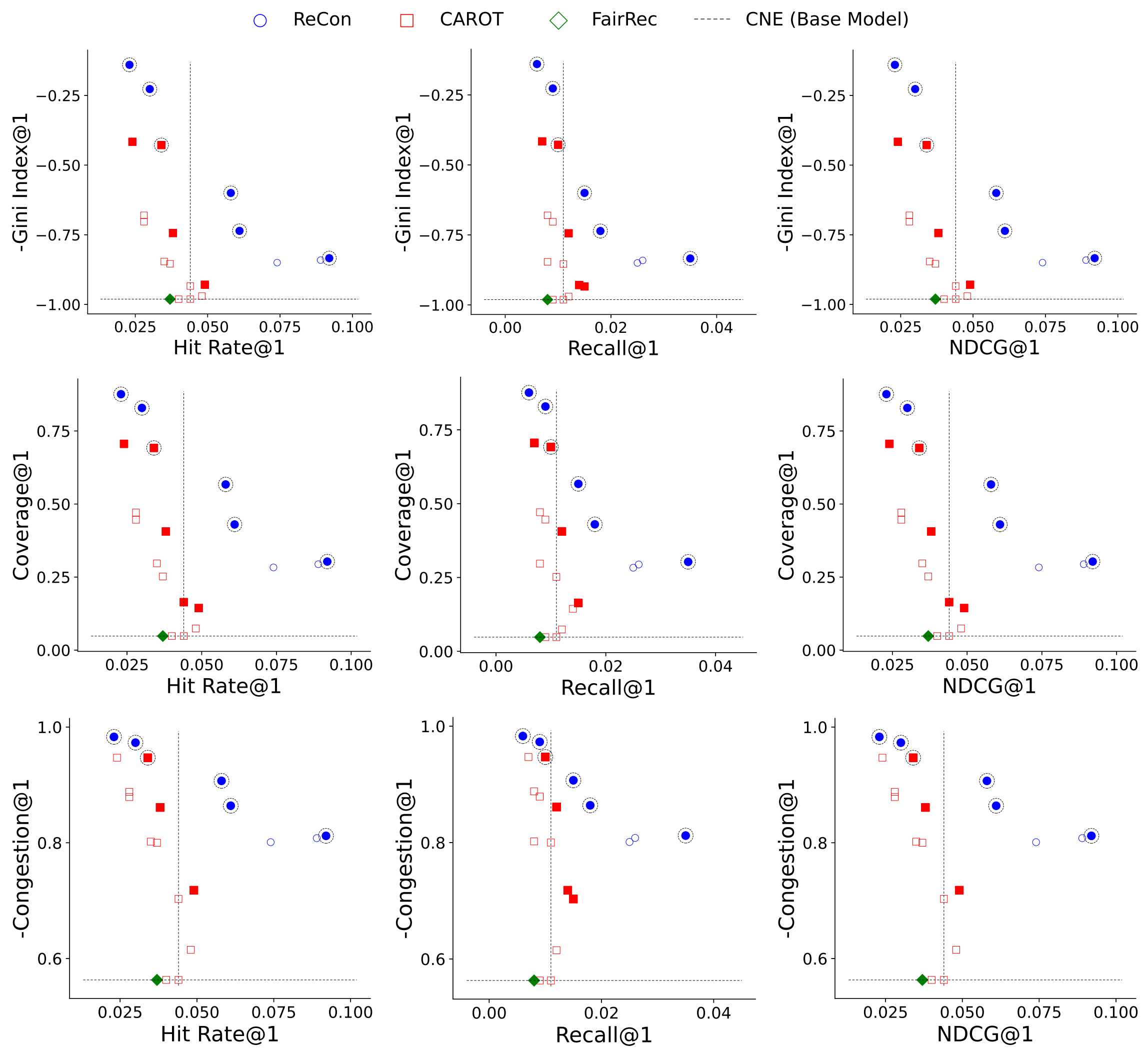

Fig. 4. Desirability versus congestion-related measures in CareerBuilder dataset for top-1 recommendation (higher values are better). Points represent different hyper-parameter combinations. Pareto optimal points per method are filled. Pareto optimal points across methods have a circle around.

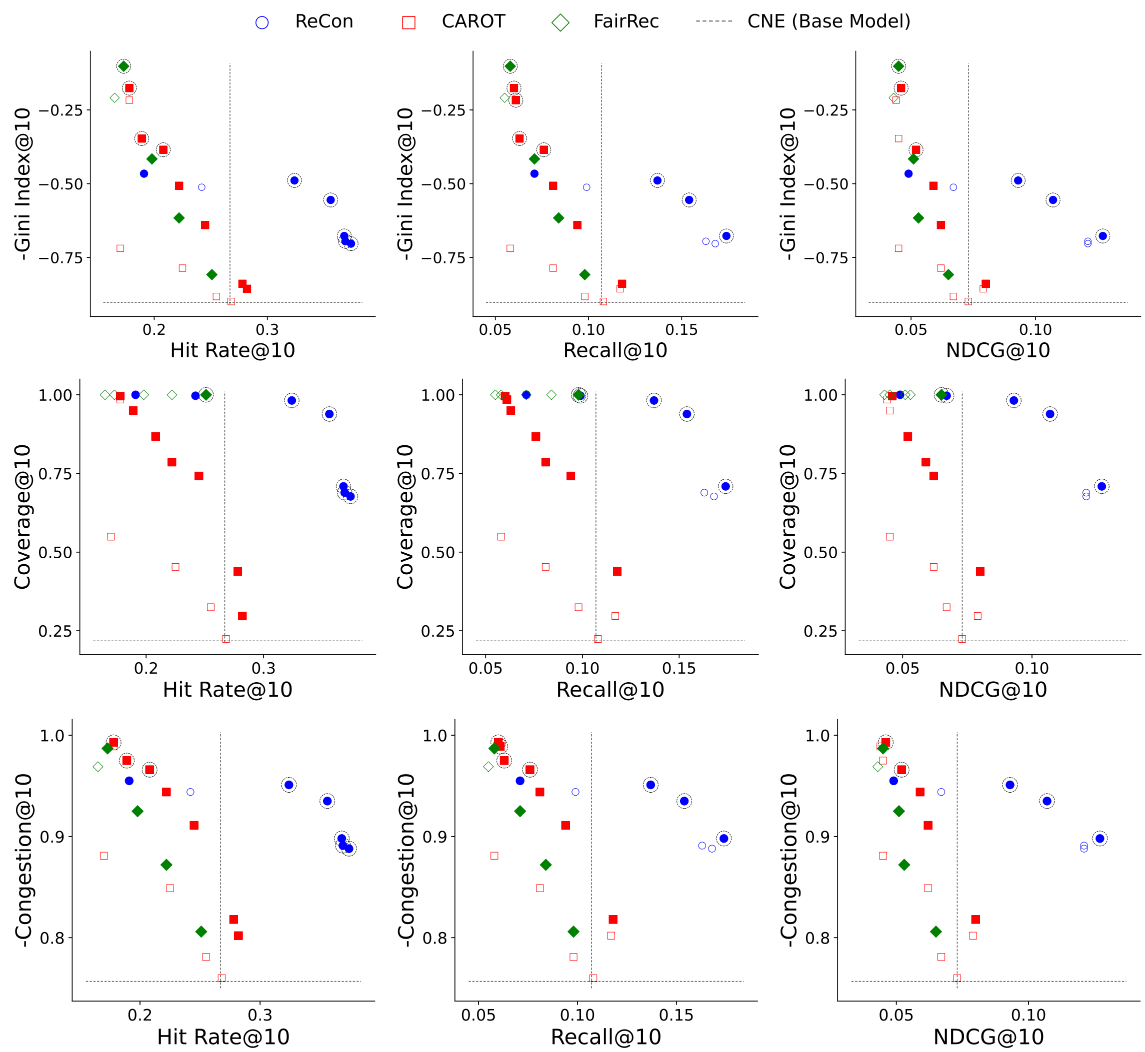

Fig. 5. Desirability versus congestion-related measures in CareerBuilder dataset for top-10 recommendation (higher values are better). Points represent different hyper-parameter combinations. Pareto optimal points per method are filled. Pareto optimal points across methods have a circle around.

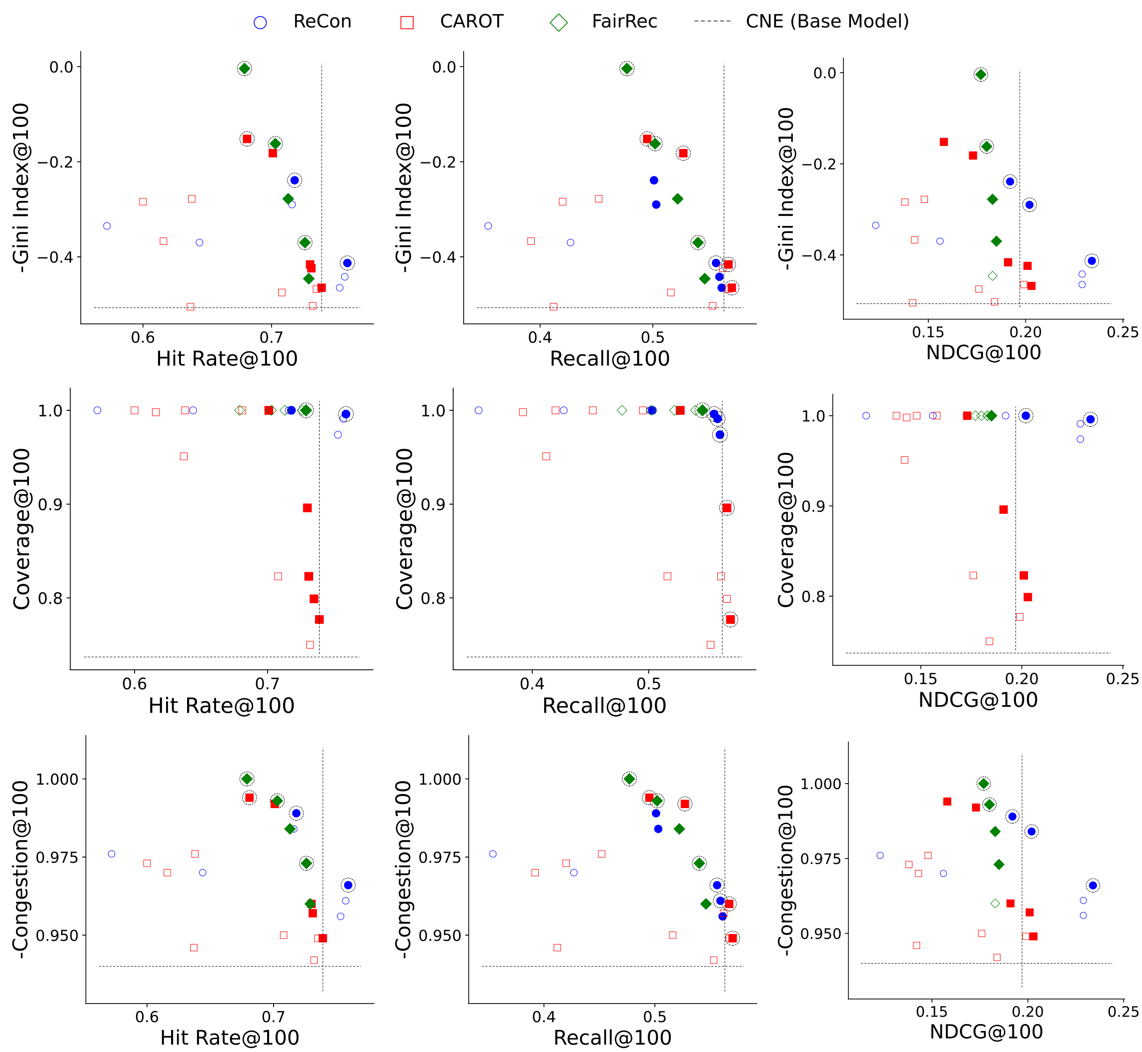

Fig. 6. Desirability versus congestion-related measures in CareerBuilder dataset for top-100 recommendation (higher values are better). Points represent different hyper-parameter combinations. Pareto optimal points per method are filled. Pareto optimal points across methods have a circle around.

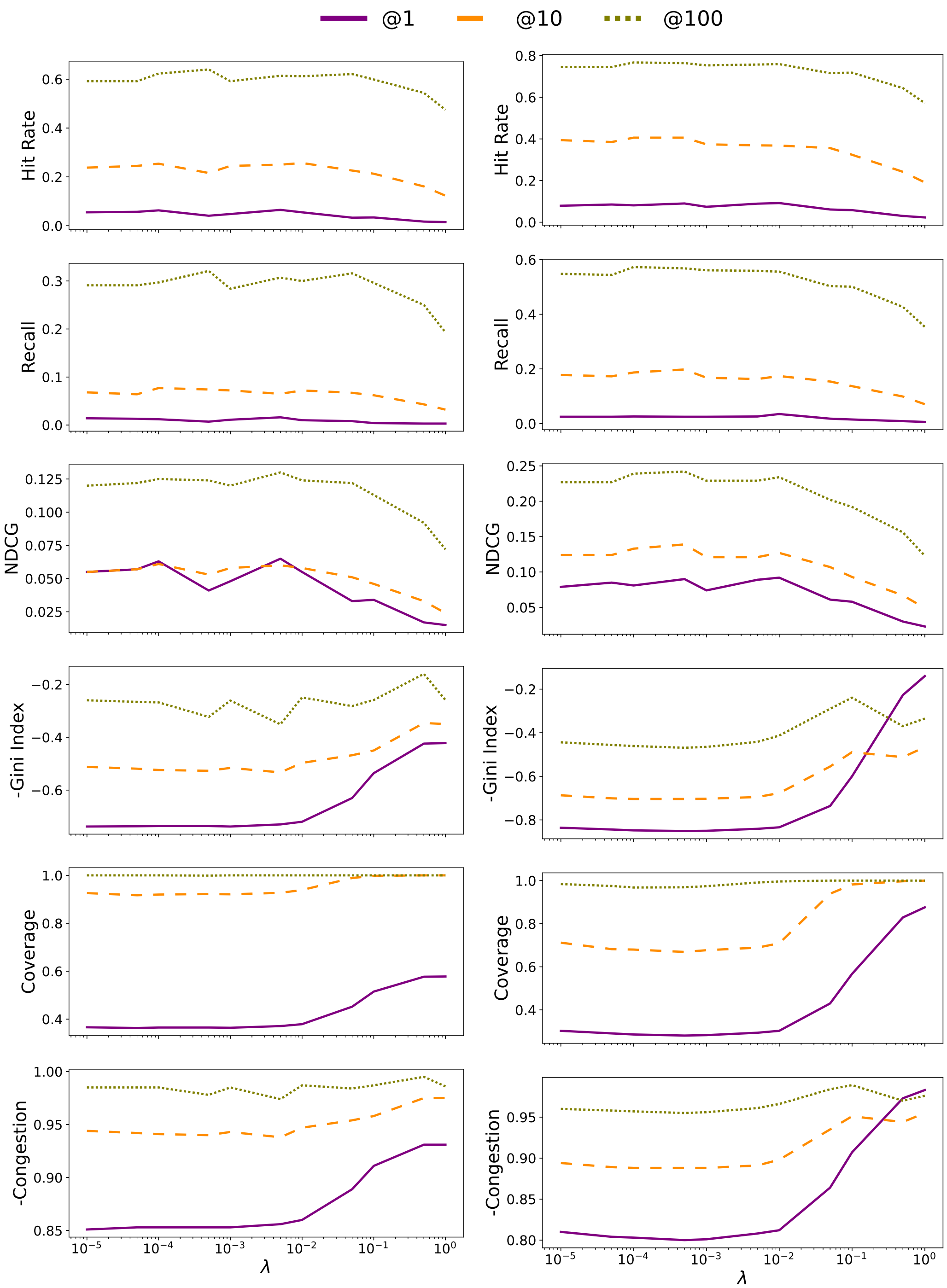

Fig. 7. Performance of ReCon for different values of λ (the weight of the optimal transport in ReCon).

REFERENCES

[1] Bo Kang, Jefrey Lijffijt, and Tijl De Bie. 2018. Conditional network embeddings. *arXiv preprint arXiv:1805.07544* (2018).