NEURAL INFORMATION PROCESSING SYSTEMS

NJIT New Jersey Institute of Technology

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Promoting Fairness Among Dynamic Agents in Online-Matching Markets under Known Stationary Arrival Distributions

Author

Will Ma[1] Pan Xu[2]

Presenter

Hai An Tran[2]

[1]Graduate School of Business, Columbia University

[2]Department of Computer Science, New Jersey Institute of Technology

Online Matching under Long-Run Fairness

OM-LF

Online Agent *j* λ_j

Offline Agent *i* b_i

Number of agents j served

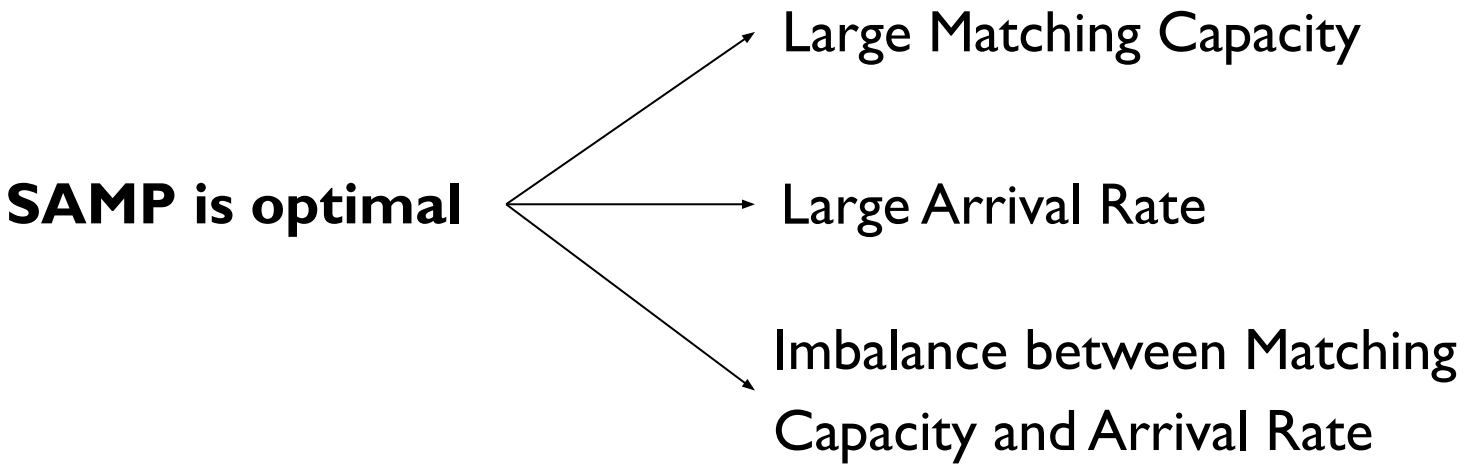
FAIR-L $\longrightarrow$ $\min_{j \in J} \frac{\mathbb{E}_{\mathcal{A},\mathsf{ALG}}[X_j]}{\mathbb{E}_{\mathcal{A}}[A_j]} = \min_{j \in J} \frac{\mathbb{E}_{\mathcal{A},\mathsf{ALG}}[X_j]}{\lambda_j}$

Number of j's arrival

Main Contributions

- **Single Offline Agent**: First-Come-First-Serve (FSCS) is optimal.

- **General Case**: LP-based Sampling (SAMP) is at least 1-1/e competitive.



Extension

Number of agents in group g

Group-Level Fairness:

$$\min_{g \in \mathcal{G}} \frac{\mathbb{E}_{\mathcal{A},\mathrm{ALG}}\left[\overbrace{X(g)}\right]}{\sum_{j \in g} \lambda_j}$$

Conditional on the randomness of ALG

Short-Run Fairness:

$$\mathbb{E}_{\mathcal{A}}\left[\min_{j \in J:\, A_j > 0} \frac{\mathbb{E}_{\mathrm{ALG}}\left[\overbrace{X_j \,|\mathcal{A}|}\right]}{A_j}\right]$$

Thank you!