Towards Individual and Multi-Stakeholder Fairness in Tourism Recommender Systems (TRS)

Ashmi Banerjee, Paromita Banik, and Wolfgang Wörndl

Technical University of Munich, Germany

The full paper was published in Frontiers in Big Data (2023).

What we will cover Today

- Introduction: Stakeholder in TRS, Multi-stakeholder TRS
- Findings from our Literature Review
- Q&A and Discussion
Introduction
Stakeholders in TRS

Consumers

Platforms

Item Providers

Society
Stakeholders in TRS

Consumers
- Matching Preferences

Platforms
- Maximize Commissions

Item Providers
- Maximize Exposure

Society
- Environmental Damage
Multistakeholder Recommender Systems

**Ideal Scenario**

→ Balances the needs of all stakeholders i.e. is fair to all of them

- ✔ Consumers (C-Fairness)
- ✔ Item Providers (I-Fairness)
- ✔ Platforms (P-Fairness)
- ✔ Society (S-Fairness)
Literature Review
Literature Review: Fairness in TRS

- Individual Stakeholder Fairness
- Multi-Stakeholder Fairness
- Challenges in Fair TRS

Classification
Literature Review: Fairness in TRS

- Individual Stakeholder Fairness
- Multi-Stakeholder Fairness
- Challenges in Fair TRS

Classification
### Individual Stakeholder Fairness in TRS

#### Main Fairness Criteria

<table>
<thead>
<tr>
<th>Fairness Type</th>
<th>Main Fairness Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumer Fairness <em>(C-Fairness)</em></td>
<td>Individual &amp; Group Fairness</td>
</tr>
<tr>
<td>Item Provider Fairness <em>(I-Fairness)</em></td>
<td>Popularity Bias, Exposure Bias</td>
</tr>
<tr>
<td>Platform Fairness <em>(P-Fairness)</em></td>
<td>Ranking Bias</td>
</tr>
<tr>
<td>Societal Fairness <em>(S-Fairness)</em></td>
<td>Sustainability</td>
</tr>
</tbody>
</table>
Individual Stakeholder Fairness in TRS

**Focus**

Total papers in TRS: 66; Stakeholder-focused papers in TRS: % breakdown

- **S-Fairness** 6.0%
- **C-Fairness** 32.0%
- **I-Fairness** 33.0%
- **P-Fairness** 29.0%

- Consumers (C-Fairness)
- Item Providers (I-Fairness)
- Platforms (P-Fairness)
- Society (S-Fairness)
Literature Review: Fairness in TRS

- **Classification**
  - Individual Stakeholder Fairness
  - Multi-Stakeholder Fairness
- **Challenges in Fair TRS**

**Overview**
Multi-stakeholder Fairness in TRS

⭐ Main Fairness Criteria

- C, I-Fairness: 50%
- C, I, S-Fairness: 10%
- C, I, P-Fairness: 30%
- C, P-Fairness: 10%
Literature Review: Fairness in TRS

- Literature Review
- Classification
- Individual Stakeholder Fairness
- Multi-Stakeholder Fairness
- Challenges in Fair TRS
Challenges in Fair TRS

⭐ Modeling Individual Stakeholder Utilities

- Utility modeling is complex in TRS due to dynamic factors such as context, seasonality, travel regulations etc.

- Most research on modeling individual stakeholder utilities such as consumers and item-providers and platform.

- Modeling of utilities of Society as a stakeholder has often been overlooked.
Challenges in Fair TRS

- Only few studies focus on multi-stakeholder relationships in TRS.
- Relationship between stakeholders can impact interactions and outcomes.
- Temporal factors & external influences affect recommendation relevance.
Challenges in Fair TRS

⭐ Explanations to improve User Interfaces

- Providing explanations behind recommendations → users understand the fairness objectives of the recommender system.

- Explanations also enhance transparency, efficiency, effectiveness, trust and user satisfaction.

- Research on explaining recommendations with a multi-stakeholder fairness objective in TRS is limited.
Challenges in Fair TRS

⭐ Insufficient Data, Missing Metrics and Evaluation

- Limited publicly available data; often relies on synthetic or proprietary datasets
- Available data lacks critical information such as user interactions, environmental metrics etc.
- Fairness metrics are domain specific and often hard to generalize for other scenarios.
- User acceptance of the fair ranked results is often overlooked.
Conclusion
Summary

- Limited exploration of fairness in the travel and tourism domain compared to other sectors.

- Neglect of responsible recommendations (S-Fairness) despite its significance in addressing over- and under-tourism and environmental concerns.

- Limited research on explaining recommendations with multi-stakeholder fairness objectives in the tourism industry.

- Challenges related to data availability, particularly detailed and representative data.

- Insufficient focus on user acceptance of re-ranked or fair recommendations in existing studies.
Thank You! Time for Q&A!

Ashmi Banerjee
ashmi.banerjee@tum.de

Paromita Banik
paromita.banik@tum.de

Wolfgang Wörndl
woerndl@in.tum.de