SIGIR 2025 Padova ITALY

International ACM SIGIR Conference on Research and Development in Information Retrieval

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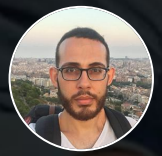
Small Data, Big Impact: Navigating Resource Limitations in Point-of-Interest Recommendation for Individuals with Autism



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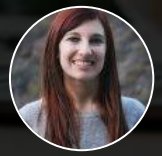

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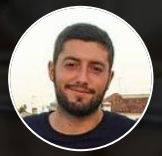

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Introduction

Context and motivation

The rise of the Autism Spectrum Disorder (ASD)

- Complex neurodevelopmental condition with rising global prevalence
- Significant increase in diagnoses across Europe, UK, and US

The key challenges for ASD Individuals

- Difficulties in social interaction
- Fear of novelty and need of rigid routine
- Atypical sensory perception leading to sensory overload
    - Spatial exploration becomes anxiety-inducing

Problem statement

- Limited work on spatial navigation assistance
- Point of Interest (POI) recommenders rely only on user preferences
- Need to incorporate sensory aversions alongside preferences
- ASD individuals heavily rely on sensory info for location decisions

Start of the art and limitations

- Small sample sizes due to limited access to ASD participants
- Challenges in conducting research with ASD individuals
- Studies typically involve only 10-30 participants
- Limited studies targeting adults with ASD, usually children
- Lack of sensory data: missing sensory information about locations

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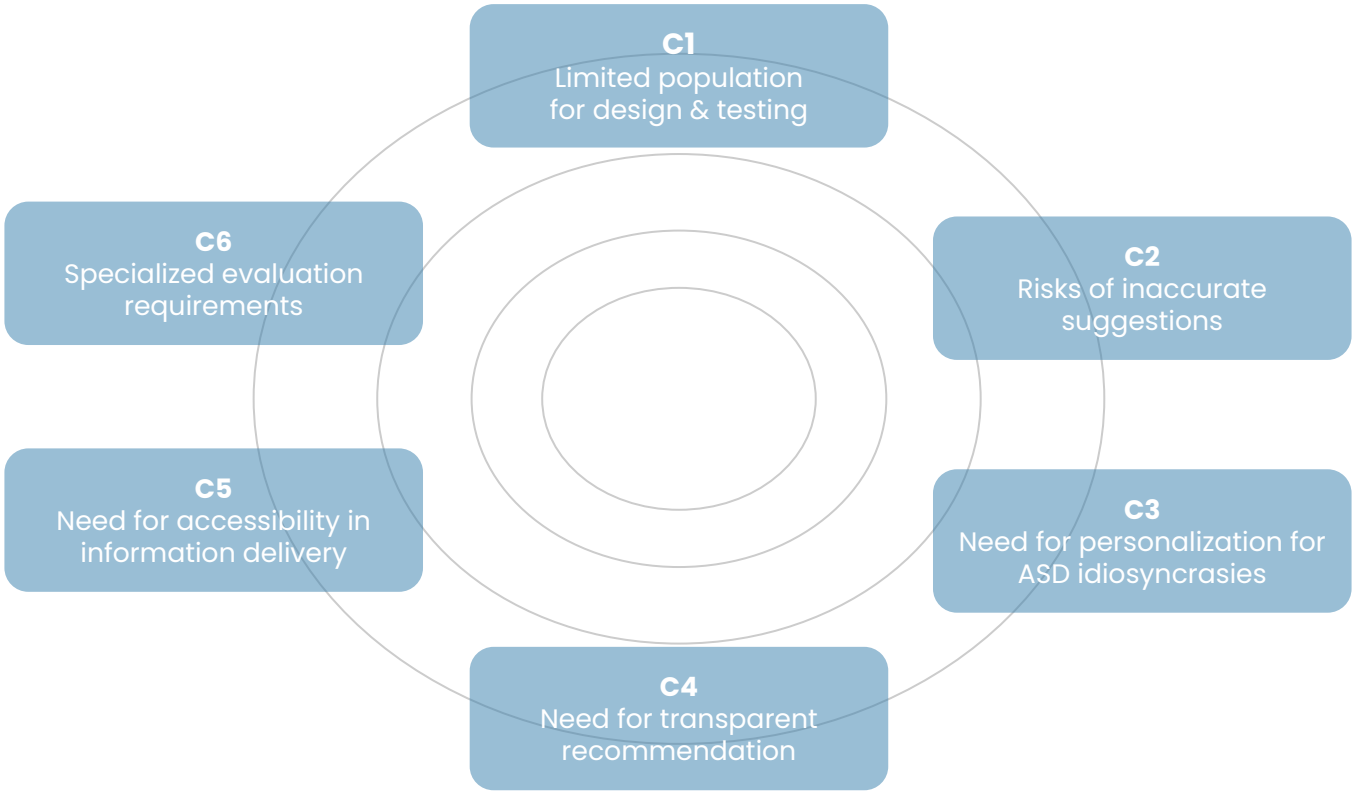
Open challenges

What makes recommendation for ASD hard



C1 Limited population for design & testing

- Autistic users represent a small portion of the overall population
- Many orders of magnitude less than needed for modern recommenders
- Reaching ASD users for research is challenging

- Insufficient gathered data for system training
- Impacts system's ability to learn and adapt to users

C2 Risks of inaccurate suggestions

- Poor recommendations can trigger sensory overload
- May cause anxiety or distress due to sensory sensitivities
- Traditional consumer scenarios: bad suggestion = user dissatisfaction
- ASD scenarios: bad suggestion = significant impact on well-being

- Effectiveness is not just about performance: it's about safety & well-being

C3 Need for personalization for ASD idiosyncrasies

- Latent factor extraction can fail to capture sensory aversions & preference
- Available information is often sparse or incomplete

- Extraction techniques from proxy sources (e.g., reviews) to fill this gap
- No links among sensory features, idiosyncratic aversions, POI preferences

C4 Need for transparent recommendation

- ASD people use structured, logic-driven decision-making processes
- Require clearer reasoning pathways to reach conclusions
- Spend significant time in collecting and analyzing information

- Provide explanations alongside recommendations
- Use reasoning pathways as explanation basis
- Reduce cognitive load through structured explanations

C5 Need for accessibility in information delivery

- Information must accommodate perceptual and cognitive patterns
- Standard interfaces may not be accessible to ASD users
- Content adaptation is essential

- Interface design tailored to ASD users' needs
- Information must be comprehensible, not just available

C6 Specialized evaluation requirements

- ASD individuals have limited attention spans & short engagement periods
- Specific cognitive characteristics

- Close coordination with healthcare professionals
- Involvement of caregivers in evaluation process

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Our progress so far

Use case context

Collaboration with the experts of the
Regional Center for Autism Spectrum Disorders in Adulthood (Turin)[1]

- Recruiting and engaging ASD users
- Gathering development requirements
- Refining our design of delivery strategies

[1] *https://www.aslcittaditorino.it/strutture/centro-pilota-regionale-disturbi-spettro-autistico-in-eta-adulta/*

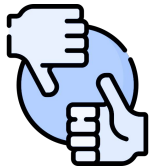
Specialized involvement protocol

Challenges [C1, C6]

Co-design with ASD specialists to create a structured involvement protocol

Participant recruitment

Ethical considerations

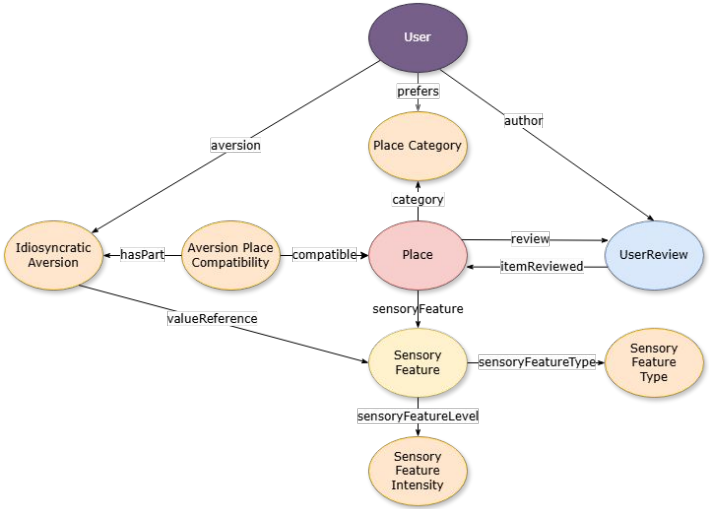


User preferences and sensory aversions collection

Graph-based data modeling

Challenges [C2, C3]

- Ontology connecting autistic users, sensory aversions, POI categories and sensory features
- Interoperability is preserved through Schema.org bindings
- KG built on this ontology includes 25k triples, 551 entities, and 5 relations



Reasoning recommendation modeling

Challenges [C4]

- Path-reasoning techniques enable explainable recommendations:
  - Reinforcement learning-based approaches, where an agent traverses the KG and extracts structured metapaths
  - Language models, which interprets KG elements as tokens and build paths through the common next-token prediction task

"We recommend this place because it's similar to one that someone with the same sensory aversions as you liked."

Tailored recommendation delivering

Challenges [C5, C6]

- Survey to collect feedback on preferred explanation formats
- Involvement of experts to:
  - adapt explanation templates to match cognitive and linguistic capacity
  - optimize user interface for mid-high functioning ASD users

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Next steps

Early insights and concluding remarks

- Several **metapath-based** explanations were **not helpful**, especially when place categories and sensory features were included
- ASD users tend to trust suggestions from people they know, but **remain skeptical of suggestions they find online** (e.g., Google, Tripadvisor)
- Most participants **get angry or stressed** when they confronted with bad advice, feeling as if they are being made fun of
- Explanation of **why a place is recommended is appreciated** and their engagement with the application is strengthened if they trust it

What comes next for our approach

- **Deploy an explainable UI:** Collect feedback from autistic users on a UI powered by path-based explainable recommender systems
- **Personalised POI algorithms:** Design recommendation methods that adapt to individual sensory aversions and preferences
- **Context-rich knowledge graph:** Enrich the KG with dynamic attributes such as typical crowd size and peak hours
- **Long-term user evaluation:** Study the trust, satisfaction, and behavioural impact of explainable recommendations over time

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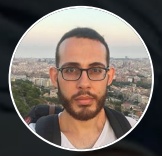

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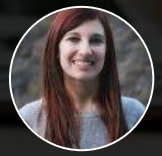

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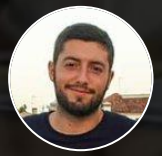

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