Offer #2024-07602

PhD Position F/M Computer-Assisted Collaborative Design of Transit Maps

Contract type : Fixed-term contract

Level of qualifications required : Graduate degree or equivalent

Fonction : PhD Position

About the research centre or Inria department

The Inria Saclay Research Centre was established in 2008. It has developed as part of the Saclay site in partnership with **Paris-Saclay University** and with the **Institut Polytechnique de Paris** .

The centre has 40 **project teams** , 27 of which operate jointly with Paris-Saclay University and the Institut Polytechnique de Paris; Its activities occupy over 600 people, scientists and research and innovation support staff, including 44 different nationalities.

Context

The Ph.D. topic lies at the intersection of **Human-Computer Interaction** and **Information Visualization**. It will be a paternship between Inria Saclay & Université Paris-Saclay (Theophanis Tsandilas) and the École Centrale de Lyon (Romain Vuillemot). During the thesis, we envision stays at both sites.

The thesis will also be linked to the ANR project GLACIS.

Assignment

Transit maps are used daily by millions of travelers. These maps provide a simple reading of often complex networks and dense interconnections of metro/bus, cycling routes, or carpool lanes. The standard representation in a geolocated directed graph must meet many codified criteria [6]: space optimization (separation and grouping, standardization), shape geometry (simplification, parallelism), and aesthetic criterion (simplification, visual language). Currently, only experts can solve these tasks manually and sequentially, starting from data to the graphics (see figure below).

(a) Model concept   (b) Venn diagram
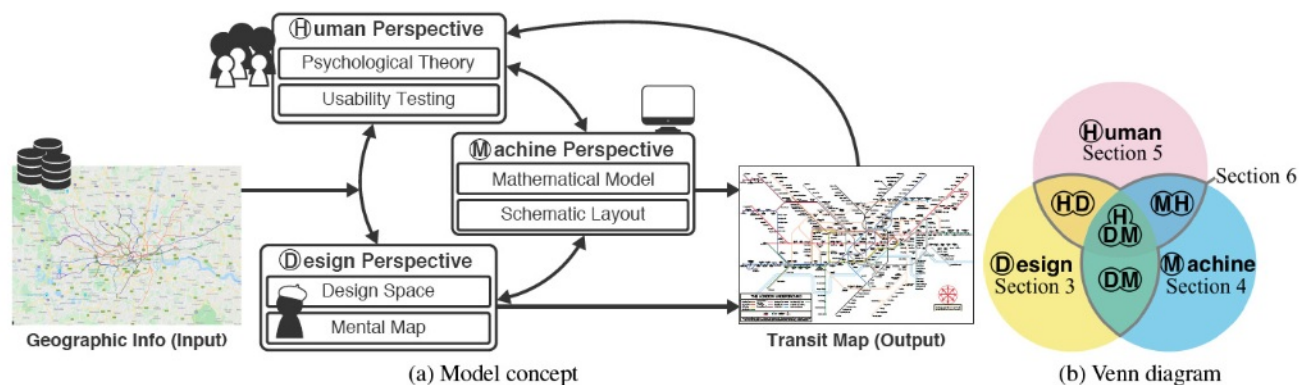
This process is lengthy, costly, and every data modification requires a new development cycle. Similarly, each modification or graphical preference will not be retained when the data is updated. This work aims to propose and implement new collaborative graphic design approaches, multi-user (e.g., data scientists, cartographers, geomaticians, designers), and to explore their assistance through new forms of automated processing (e.g., drawing algorithms, language and generative models).

The main challenges to be addressed are 1) capturing and abstracting user interactions, collaborative mechanics (consensus, conflict, suggestion) assisted by models (parameterization, query, validation), 2) formalization in collaborative learning bases allowing asynchronous, bidirectional, and reproducible work, 3) validation and retraining of models and their generalization to new data and geographic locations.

Main activities

Thesis Organization:

1. **User study** focused on collaborators and their practices [5]; **identification of collaboration mechanics** and **state of the art** of map generation assistance models; establishment of a **structured collection** of transit map examples [4].
2. **Formalization of visual grammar** associated with **collaborative interaction techniques** for design, modification, and validation of grammar.
3. **Design of a graphical interface** and architecture for generation, editing, and retraining of maps manipulated by users coupled with automated processes.
4. **Testing and user evaluation** with new map comparison techniques [2]; user validation.
5. **Publications**: IEEE Vis, ACM CHI conferences, IUI, and/or journals TVCG, ToCHI, and specialized conferences or workshops (Graph Drawing, VisXai).

References

[1] A. Bigelow, S. Drucker, D. Fisher, and M. Meyer. Reflections on How Designers Design with Data. In Proceedings of the 2014 International Working Conference on Advanced Visual Interfaces, AVI '14, pages 17–24, New York, NY, USA, 2014. ACM.

[2] M.-J. Lobo, E. Pietriga, and C. Appert. An Evaluation of Interactive Map Comparison Techniques. In Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems, CHI '15, pages 3573–3582, New York, NY, USA, 2015. ACM.

[3] T. Tsandilas. StructGraphics: Flexible Visualization Design through Data-Agnostic and Reusable Graphical Structures. IEEE Transactions on Visualization and Computer Graphics, 27(2):315–325, Feb. 2021. Conference Name: IEEE Transactions on Visualization and Computer

Graphics.

[4] R. Vuillemot, T. Leysens, P. Rivière, and A. Tabard. An Online Corpus of Isochrone Maps. In CityVis – Urban Data Visualization, Berlin, Germany, 2018.

[5] R. Vuillemot, P. Rivière, A. Beignon, and A. Tabard. Boundary Objects in Design Studies: Reflections on the Collaborative Creation of Isochrone Maps. Computer Graphics Forum, June 2021. Publisher: Wiley.

[6] H.-Y. Wu, B. Niedermann, S. Takahashi, M. J. Roberts, and M. Nollenburg. A Survey on Transit Map Layout – from Design, Machine, and Human Perspectives. Computer Graphics Forum, 39(3):619–646, 2020. eprint: https://onlinelibrary.wiley.com/doi/pdf/10.1111/cgf.14030.

[7] H. Xia, N. Henry Riche, F. Chevalier, B. De Araujo, and D. Wigdor. DataInk: Direct and Creative Data-Oriented Drawing. In Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems, pages 1–13, Montreal QC Canada, Apr. 2018. ACM.

Skills

The candidate is expected to have a Master degree (M2-level for the French system) and background in Human-Computer Interaction, Information Visualization, or Computer Graphics. The candidate must have solid programming skills and be enthusiastic about conducting research in a topic that combines the above fields.

Benefits package

- Subsidized meals
- Partial reimbursement of public transport costs
- Leave: 7 weeks of annual leave + 10 extra days off due to RTT
- Possibility of teleworking (after 6 months of employment) and flexible organization of working hours
- Professional equipment available (videoconferencing, loan of computer equipment, etc.)
- Social, cultural and sports events and activities
- Access to vocational training
- Social security coverage

Remuneration

1st and 2nd year : 2082€ gross/month

3rd year : 2190€ gross/month

General Information

- **Theme/Domain :** Interaction and visualization
  IT Infrastructure (BAP E)
- **Town/city :** Gif-sur-Yvette
- **Inria Center :** Centre Inria de Saclay
- **Starting date :** 2024-10-01
- **Duration of contract :** 3 years
- **Deadline to apply :** 2024-08-31

Contacts

- **Inria Team :** EX-SITU
- **PhD Supervisor :**
  Tsantilas Theofanis / Theophanis.Tsandilas@inria.fr

About Inria

Inria is the French national research institute dedicated to digital science and technology. It employs 2,600 people. Its 200 agile project teams, generally run jointly with academic partners, include more than 3,500 scientists and engineers working to meet the challenges of digital technology, often at the interface with other disciplines. The Institute also employs numerous talents in over forty different professions. 900 research support staff contribute to the preparation and development of scientific and entrepreneurial projects that have a worldwide impact.

Instruction to apply

Defence Security :
This position is likely to be situated in a restricted area (ZRR), as defined in Decree No. 2011-1425 relating to the protection of national scientific and technical potential (PPST).Authorisation to enter an area is granted by the director of the unit, following a favourable Ministerial decision, as defined in the decree of 3 July 2012 relating to the PPST. An unfavourable Ministerial decision in respect of a position situated in a ZRR would result in the cancellation of the appointment.

Recruitment Policy :
As part of its diversity policy, all Inria positions are accessible to people with disabilities.