



Two-years postdoc position in audio signal processing and optimal transport in Toulouse

Supervised by Elsa Cazelles and Cédric Févotte (CNRS)

Description of work

The objective of the postdoc position is to conduct research on the **interpolation of audio signals** using **optimal transport** (OT). Our applicative goal is to generate artificial sounds between source and target signals for artistic and music editing purposes. While OT has been thoroughly used for the interpolation of images, see, e.g., [1], it has scarcely been used in the audio setting, with the exception of [2] (see also [3, 4] for other applications such as transcription and classification). Our aim is to work in the time-frequency domain and generate interpolants between source and target time-frequency distributions. A specific problem pertaining to the audio setting will consist in designing a suitable OT cost matrix that efficiently captures the time-frequency structure of audio signals, as well as algorithms that scale with the dimension of audio spectrograms. Another problem will consist of reconstructing a suitable phase for the time-frequency interpolant, that may incorporate information about the phases of the source and target signals.

The postdoc researcher will face exciting problems in audio modelling, phase reconstruction and optimisation with Wasserstein distances. She/he may also address theoretical questions about the properties of Wasserstein barycenters.

Host institution and place of work

The successful candidate will be employed by the **Centre National de la Recherche Scientifique** (CNRS, the National Center for Scientific Research). CNRS is the largest state-funded research organisation in France, involved in all scientific fields. The postdoc researcher will join the **Institut de Recherche en Informatique de Toulouse** (IRIT), a joint laboratory of CNRS and Toulouse universities & engineering schools. IRIT is among the largest computer & information sciences labs in France. Toulouse is the fourth-largest city in France, the capital of the Occitanie region in the South-West of France, and is praised for its high quality of living. The physical location for the project is the ENSEEIHT campus, in a lively neighbourhood of the city center.

Candidate profile and application

Prospective applicants should have a PhD in **signal processing**, **machine learning**, **optimal transport**, or a related discipline, good programming skills, and good communication skills in English, both written and oral. The net monthly salary is 2250€ for researchers with less than 2 years of professional experience after the PhD, and starts from 3200€ in other cases. The position comes with health insurance & other social benefits.

Applicants are requested to send a CV, a brief statement of research interests and the contact details of two referees in a single PDF file. Applications will be collected until early March 2023 and then on until a suitable candidate is found.

Applications and informal enquiries are to be emailed to elsa.cazelles@irit.fr and cedric.fevotte@irit.fr

References

- [1] Gabriel Peyré and Marco Cuturi. Computational optimal transport: With applications to data science. *Foundations and Trends in Machine Learning*, 11(5-6):355–607, 2019.
- [2] Trevor Henderson and Justin Solomon. Audio transport: a generalized portamento via optimal transport. In *Proc. International Conference on Digital Audio Effects (DAFx)*, 2019.
- [3] R. Flamary, C. Févotte, N. Courty, and V. Emiya. Optimal spectral transportation with application to music transcription. In *Advances in Neural Information Processing Systems (NIPS)*, Dec. 2016.
- [4] Elsa Cazelles, Arnaud Robert, and Felipe Tobar. The Wasserstein-fourier distance for stationary time series. *IEEE Transactions on Signal Processing*, 69:709–721, 2021.