Postdoc: tensor methods for deep learning

Duration: 24 months
Where: Nancy (France)

Postdoctoral position in the frame of a joint project between two laboratories:
- Institut Elie Cartan de Lorraine (IECL),
- Centre de Recherche en Automatique de Nancy (CRAN).

Both laboratories are joint research units of CNRS and University of Lorraine.

Supervisors:
- Marianne Clausel (IECL, Probability and Statistics research group)
  Website : https://sites.google.com/site/marianneclausel/home?authuser=0
- Konstantin Usevich (CRAN, Mulditimensional Signals research group)
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A postdoctoral position is co-funded by Agence Nationale de Recherche (project LeaFleT) and Grand-Est Region (project Self-IA). The main goal is to develop new deep learning approaches combining low-rank tensor approximations [LGR+15], Neural Architecture Search [EMH19] and flexible activation functions [ZUMB21]. A range of research questions are considered such as efficient algorithms, theoretical guarantees on the performance of the neural network as a function of the compression rate, properties of the tangent kernel [JGH18] associated to a neural network, combination with transfer learning.

The main targeted applications are object detection, time series classification and natural language processing. The project will be performed in collaboration with the SME Two-I (based in Metz, near Nancy) academic institutions, such as laboratories LIG and GIPSA-Lab (Grenoble, France), and, potentially, other local institutions, such as LORIA and GeorgiaTech Lorraine.

The postdoctoral researcher will be based in IECL and CRAN at Campus Sciences (Vandœuvre-lès-Nancy). He/she will benefit from active interaction between researchers in mathematics, automatic control and computer science. The postdoc will be provided with all necessary computing resources as well as with funding for travel to conferences and research visits.

Salary: 2400–3000 € net, depending on experience.

Person specification

- PhD in **machine learning, applied mathematics, signal processing**, or a related discipline.
- Excellent programming skills; good knowledge of Python.
- Experience with one of the deep learning frameworks.
- Experience with tensor decompositions is not required, but will be a plus.
- Fluency in English, written and oral; good communication skills.

Application procedure

Applicants are requested to send by email a CV, list of publications, motivation letter, and contact details of two references, preferably in PDF. The expected starting date is January 2022.

Please send enquiries to konstantin.usevich@univ-lorraine.fr and marianne.clausel@univ-lorraine.fr.

References

[EMH19]   Thomas Elsken, Jan Hendrik Metzen, and Frank Hutter. Neural architecture search: A survey. *Journal of Machine Learning Research*, 20:1–21, 2019.

[JGH18]   Arthur Jacot, Franck Gabriel, and Clément Hongler. Neural tangent kernel: convergence and generalization in neural networks. In *Proceedings of the 32nd International Conference on Neural Information Processing Systems*, pages 8580–8589, 2018.

[LGR+15] Vadim Lebedev, Yaroslav Ganin, Maksim Rakhuba, Ivan V Oseledets, and Victor S Lempitsky. Speeding-up convolutional neural networks using fine-tuned CP-decomposition. In *ICLR (Poster)*, 2015.

[ZUMB21] Yassine Zniyed, Konstantin Usevich, Sebastian Miron, and David Brie. Tensor-based framework for training flexible neural networks. *arXiv preprint arXiv:2106.13542*, 2021.