PhD Studentship: Knowledge integration for improving deep learning in computer vision

Supervision: PRISME/LIFO (Orléans University - France)

The University of Orléans, France, is offering a fully funded PhD studentship. The position is for 3 years with a monthly net salary of EUR 1,412. This thesis is supported by **ANR** (National Research Agency) and **University of Orléans** in the context of the **project AI.iO** (Artificial Intelligence in Orléans: Learning from heterogeneous data and expert knowledge. Applications in geological and environmental sciences). The thesis will be supervised by researchers from two laboratories of the University of Orléans: PRISME (*Laboratoire Pluridisciplinaire de Recherche en Ingénierie des Systèmes, Mécanique, Énergétique*) and LIFO (*Laboratoire d'Informatique Fondamentale d'Orléans*). These laboratories collaborate via their complementarities in computer vision, machine learning and knowledge representation.

We are looking for a candidate who has recently received a Master's degree in a relevant field such as Computer Science, or similar. Particular strength or experience in computer vision, machine learning, data mining, computer programming or applied mathematics is highly appreciated. French and/or English are the working languages.

The ****deadline for submitting the application**** is **August 24th 2020**, but the candidates are encouraged to contact us as soon as possible. **Start is expected around October 2020**. Your complete application consists of the documents below, which should be sent as a single PDF file to Frédéric Ros (frederic.ros@univ-orleans.fr) and Christel Vrain (christel.vrain@univ-orleans.fr)

- CV with photo
- One-page cover letter (clearly indicating available start date as well as relevant qualifications, experience and motivation)
- University certificates and transcripts (both B.Sc and M.Sc degrees)
- Contact details of up to three referees
- Possibly an English language certificate and a list of publications
- **Attention:** all documents should be in English or French.

Abstract

Despite the success of deep learning architectures in many fields and particularly in computer vision, deep learning is far from being deployed in many real-world applications as there still exist many concerns related to robustness, reliability, computational time and explainability. The underlying theoretical foundation related to deep learning does not yet explain under what conditions they will perform well or outperform mother approaches, and how to determine the optimal structure for a certain task. A great boost in the performance of neural networks can be obtained through the *exploitation of domain knowledge*, e.g. problem specific information that can be used to improve the deep learning model and/or simplify the training process and improve *model explainability*. This research direction in deep learning is emerging and has been typically addressed in relative isolation and via ad'hoc approaches. The research in the thesis aims at firstly formalizing and analyzing the different branches of knowledge integration in deep learning models in the image field, possibly in presence of heterogeneous data. In a second time it aims at developing / improving novel deep learning architectures that can integrate a priori expert knowledge. Applications will be done in popular image benchmarks and databases coming from the environmental fields to test the innovations proposed in the thesis. Attention will be done to a particular application in the *environmental field*. As a final and ideal objective, this work intends to delineate the preliminary

definition of a framework for knowledge integration unifying the different branches and devoted to the environmental field.

The thesis aims specifically at:

- Updating the state of the art of deep learning architectures in computer vision
- Exploring and analyzing different branches of knowledge integration in deep learning architectures devoted to image.
- Evaluating different image databases with a particular attention to the environmental databases
- Proposing novel (or improved) knowledge integration mechanisms that improve performances of deep learning models.

References

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Contact details

For further information about the studentship, please, contact Christel Vrain (christel.vrain@univ-orleans.fr) or Frédéric Ros (Frederic.Ros@univ-orleans.fr)

For more information about the research groups concerned by the thesis, see:

http://www.univ-orleans.fr/lifo/equipe.php?lang=en&id=1,
https://www.univ-orleans.fr/fr/prisme/la-recherche/axe-image-vision

For more information on the University see http://www.univ-orleans.fr/. Orléans, France is one hour by train from Paris and not far from the famous castles of the Loire River valley.