PhD position in Deep Neural Networks with Dempster Shafer Theory

Research Area

Deep Neural Networks, Artificial Intelligence, Machine Learning, Belief Functions, Dempster-Shafer Theory

Description

We are seeking a highly motivated and talented PhD student to join our research team at University of Artois - LGI2A - Decision and Information Fusion theme (DFI) - Béthune - France - (https://www.lgi2a.univ-artois.fr/spip/en/) focused on advancing the state-of-the-art in deep neural networks using Dempster Shafer theory of evidence. The successful candidate will have the opportunity to work on cutting-edge research projects and collaborate with other researchers in the field.

Subject

Deep neural networks (DNNs) refer to predictive models that exploit multiple layers of artificial neurons to compute a prediction [1,4]. In the original version, the layers are sequential and each neuron in a layer is connected with neurons in the previous layer. Many other alternative architectures have been proposed to adapt DNNs to solve specific and complex problems.

On the other hand, a theory called Dempster-Shafer theory of belief functions, or theory of evidence [15], has emerged as a rich and flexible generalization of the Bayesian probability theory, able to deal with imperfect (uncertain, imprecise, …) information. It is notably used in a growing number of applications such as classification (e.g. [2]), clustering (e.g. [3,7]) or information fusion (e.g. [5,13]).

Recent works [6,16,17] have shown the interest of enriching a DNN with an additional distance-based Dempster Shafer layer [2] for predicting belief functions. These belief functions can be of great interest to represent a reality as faithfully as possible, for example to perform a partial classification [8], i.e. decisions in favor of a group of classes.

The main idea of this thesis is to develop such deep evidential networks in more depth by exploiting methods developed at LGI2A allowing one to consider finer knowledge about the quality [12, 14] and the dependence of information [11], or the ignorance in predictions [9,10].

Two applications are envisaged: Image analysis from drones and fish population analysis.

References

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Responsibilities

- Conduct research on deep neural networks with a Dempster-Shafer Layer
- Collaborate with other researchers on research projects
- Write and publish research papers in top-tier conferences and journals
- Present research findings at conferences and workshops
- Contribute to the development of new algorithms and techniques for deep neural networks

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Qualifications

- Master's degree or equivalent in Computer Science or a related field
- Strong background in machine learning and deep learning
- Experience with programming languages such as Python and TensorFlow / Keras
- Excellent written and oral communication skills
- Strong problem-solving and analytical skills

Place of work and salary

University of Artois - LGI2A - Béthune - France - (https://www.lgi2a.univ-artois.fr/spip/en/). Salary about 1 975 euros before taxes.

How to apply

To apply, please send an email to sebastien.ramel@univ-artois.fr, frederic.pichon@univ-artois.fr and david.mercier@univ-artois.fr with the following documents grouped in one pdf file

- Your CV
- A motivation letter (max 2 pages)
- Your grades for the current year (Master's degree or equivalent) and the past years (University levels)
- [optional] at most two recommendations.

Looking forward to receiving your application