Stability and robustness of Deep Learning models to process video from thermal cameras

Keywords: Deep-Learning, Video processing, Robustness
Duration: 4 to 6 months
Supervisors: Quentin Barthelemy, Alexandre Allauzen
Contact: alexandre.allauzen@dauphine.psl.eu

Context

For a couple of decades, Deep Learning (DL) added a huge boost to the already rapidly developing field of computer vision. While for some kind of data and tasks, DL is the most successful approach, this is not the case for all applications. For instance, the analysis of video streams generated by thermal cameras is still a research challenge because of the long range perimeter and the associated geometrical issues, along with the frequent calibration change. Therefore, the stability and robustness of DL models must be better characterized and improved.

Outline

The long term goal is to design a Deep architecture that can explicitely deal with these peculiarities, along with providing theoritical guarantees on the stability of the prediction and the underlying invariances. During this internship, we will focus on the projective geometry peculiarities of the data. The goal is to propose new architectures that can deal with the perspective effect, while convolutional network are only scale invariant.
As a starting point, the recent work of [1] proposes an interesting mathematical tool to charaterize the stability and the generalization capacity of convolutional network. This paper is important to better explain the lack of robustness of the DL models to some kind of examples like adversarial ones [2].

In practice

The internship is co-supervised by Q. Barthélemy (FoxStream) and A. Allauzen (MILES-LAMSADE, Dauphine Université). The location of the internship is not yet determined and the internship could be totally and partially remote. The experimental setup will rely on the pytorch library (in python) to implement deep-learning model. The internship can be the starting point of an industrial PhD Thesis (CIFRE).
If you are interested in or if you have questions, feel free to contact us with a CV.

References

[1] Alberto Bietti and Julien Mairal. Group invariance, stability to deformations, and complexity of deep convolutional representations. *Journal of Machine Learning Research*, 20(25):1–49, 2019.

[2] Christian Szegedy, Wojciech Zaremba, Ilya Sutskever, Joan Bruna, Dumitru Erhan, Ian Goodfellow, and Rob Fergus. Intriguing properties of neural networks. In *International Conference on Learning Representations*, 2014.