Master 1: INTERNSHIP PROPOSAL

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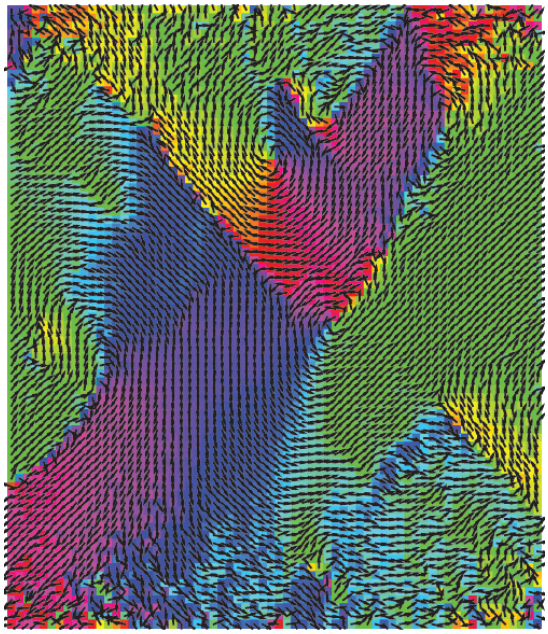
Internship location: ENS

Funding: NO

Knit-quakes prediction through deep learning



We have recently shown that a model knitted fabric exhibits crackling noise in its force response that corresponds to extended fault-like slip bands in its spatial deformation field. The scale invariance displayed by these features, together with their morphology, is strongly reminiscent of seismic events. This system can thus, to some extent, be considered as a toy model for earthquakes.

On the other hand, the emergence of extremely powerful machine learning techniques, mainly represented by elaborate artificial neural networks and so-called "deep learning", has given some hope to the geophysical community that some aspects of the geo-seismic activity could be inferred from past measurements, the Graal of which being, of course, accurate earthquake prediction. In this case however, the large amounts of data required to train deep nets to be able to predict geophysical activity are very costly to gather and hard to access, and thus far seemingly not sufficient.

On the contrary, in our model setting, we can produce vast amounts of data at virtually zero cost and moderate time. The objective of the internship is thus to collect and analyze "seismic" data from the deformation of a model knit on the one hand, and to try to train a neural networks on the corresponding time series to predict relevant knit-quake quantities.

The internship is both experimental and theoretical and calls on to various techniques: fabrication and characterization of knitted samples, fine force/displacement measurements, image processing and, on the theoretical side, identifying relevant neural network architectures and input/output formats.

Please, indicate which speciality(ies) seem(s) to be more adapted to the subject:

Condensed Matter Physics:	YES	Macroscopic Physics and complexity:	YES
Quantum Physics:	NO	Theoretical Physics:	YES