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https://www.imperial.ac.uk/non-destructive-evaluation/about/people/

Dr. Stefano Mariani Research Associate
Dr. Quentin Rendu Research Associate

Non-destructive evaluation of structures using machine learning

Master's degree thesis to be conducted at Imperial College London

Supervisors at Imperial College London: Dr. Peter Huthwaite, Dr. Stefano Mariani, and Dr. Quentin Rendu

Project summary:

Seeking for a motivated student willing to do his thesis on the topic of machine learning applied to real engineering problems.

The project aims at applying machine learning techniques to solve real engineering problems related to non-destructive-evaluation. We are currently working at the detection of defects in steel plates through the automated analysis of ultrasonic signals. The database of ultrasonic signals is generated by finite element software. Pre-processing of the data is done through Matlab and Python scripts and an artificial neural network is implemented in Python using Keras and TensorFlow libraries.

The appointed student will have the opportunity to refine and develop the learning algorithm using a database of ultrasonic signals. If necessary, more data can be generated by the student itself using an in-house finite element software capable of fast simulations of ultrasonic wave propagation in solids. Support will also be provided by a Professor in the Mathematics department at Imperial College who has long experience in machine learning and who has expressed interest in following the project.

The project will consist of the following:

- Conduct a literature review on machine learning techniques applied to ultrasonic signals
- Generate new data if needed
- Optimise neural network architecture for binary classification ("defect"/"no defect")
- Evaluate neural networks for localisation of the defects (regression or classification)
- Investigate other machine learning algorithms
- Evaluate the robustness of the method on different geometries

Desirable skills:

1. Python proficiency (or of other similar software, e.g. Matlab)
2. Previous exposure to machine learning algorithms (experience in Keras/TensorFlow environment will be appreciated)
3. Previous exposure to finite element software

Additional information:

The length of the project is flexible, from a minimum of 3 months. Funding is not provided. No scholarship fees have to be paid. The student will be given a desk/personal computer at the Non Destructive Evaluation group laboratory at Imperial College.

For further information contact Stefano Mariani (s.mariani@imperial.ac.uk). To apply please send your CV to Stefano Mariani. The selection process will include a skype interview.

Sincerely,

Stefano Mariani

Quentin Rendu