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Postdoctoral

Ecole/Institution/Société:
ETH Zurich, **Switzerland / Zurich**

Discipline:
Machine Learning

Type d'emploi::
Full-time

Date de publication:
2022-04-18

Personne à contacter:
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PhD position: material failure prediction with physics-induced machine learning

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The Chair of Computational Mechanics of Building Materials in the Institute for Building Materials and the Chair of Intelligent Maintenance Systems in the Institute of Construction & Infrastructure Management at ETH Zurich have an opening for a PhD student position in modeling material failure prediction with physics-induced neural networks.

Project background

The Chair of Computational Mechanics of Building Materials conducts research at the interface between mechanics, materials and scientific computing. Research activities are focused on modeling the link between micro- to meso-scale properties of engineering and biological materials and their macroscale mechanical performance.

Various failure mechanisms, such as dynamic fracture and the onset of frictional sliding are at the center of our interests. The overall objectives are the development of numerical models in a high-performance computing framework, and their application in establishing a fundamental understanding of multiscale material mechanics.

The Chair of Intelligent Maintenance Systems focuses on developing intelligent algorithms to improve performance, reliability and availability of complex industrial assets and making the maintenance more cost efficient. Our research focuses on deep learning, domain adaptation, hybrid approaches (combing physical performance models and deep learning algorithms), and deep reinforcement learning. The data we are typically dealing with comprises heterogeneous multivariate time series data of different types, with different sampling rates and different degrees of uncertainties.

Job description

The PhD position will focus on the development of a physics-induced (graph) neural network framework applied to the prediction of the failure of complex materials with specific micro-mechanical structures. Prediction of material failure is a complex problem because it is largely affected by disorder in the microstructure.

While the average material performance of a given microstructure is well described by homogenization techniques, the exact prediction for a specific material element is extremely challenging.

The objective of this project is to develop a physics-induced machine learning approach based on (graph) neural networks and reinforcement learning algorithms to predict the overall strength of a given piece of material. The candidate will be responsible for the development of machine learning framework, its implementation, and validation with data from numerical simulations.

The position is available with starting dates as soon as possible.

We offer

ETH Zurich is a family-friendly employer with excellent working conditions. You can look forward to an exciting working environment, cultural diversity and attractive offers and benefits.

Your profile

Prospective applicants should hold an MSc in an engineering, physics or a related discipline. The candidate should have a strong background in machine learning and deep learning with preferably a specialization on at least one of the following areas: graph neural networks, reinforcement learning and physics-informed neural networks.

Additionally, experience in mechanics, material science, and numerical modeling with FEM or DEM is desired. The candidate is expected to be fluent in English, to show and maintain scientific integrity, and to have programming experience. The successful candidate shows enthusiasm for conducting original research and strives for scientific excellence.

About ETH Zürch

ETH Zurich is one of the world's leading universities specialising in science and technology. We are renowned for our excellent education, cutting-edge fundamental research and direct transfer of new knowledge into society. Over 30,000 people from more than 120 countries find our university to be a place that promotes independent thinking and an environment that inspires excellence. Located in the heart of Europe, yet forging connections all over the world, we work together to develop solutions for the global challenges of today and tomorrow.

- CV
- academic transcript/list of courses completed
- copy of your master thesis
- a brief statement describing your project idea relevant to the job description, making connection to your experience in this area and the related work from the literature
- name and contact details of two referees

Please note that we exclusively accept applications submitted through our online application portal. Applications via email or postal services will not be considered.

For further information please visit our websites www.ifb.ethz.ch/compmech/ and https://ims.ibi.ethz.ch/ or contact Prof. David Kammer by e-mail dkammer@ethz.ch (no applications).

Job details

Title: PhD position: material failure prediction with physics-induced machine learning

Employer: ETH Zurich

Location: Rämistrasse 101 Zurich, Switzerland

Job type: PhD

Field: Artificial Intelligence, Machine Learning, Mechanics, Programming Languages

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