

COLLABORATIVE RESEARCH CENTER 837

# INTERACTION MODELING IN MECHANIZED TUNNELING



Research Department  
SUBSURFACE MODELING & ENGINEERING

RUB

SFB 837 – WEBINAR: 2 KEYNOTES – 1 LECTURE

**20.07.2021, 13:00 - 15:00 UHR**

APPLICATIONS OF MACHINE LEARNING PROCESSES  
IN TUNNEL CONSTRUCTION

ZOOM WEBINAR:

[PLEASE USE THIS LINK](#)

Meeting-ID: 977 0900 8743

Passwort: 656500

## WHY REINFORCEMENT LEARNING-BASED PROCESS OPTIMISATION SHOULD BE USED IN CONVENTIONAL TUNNELLING

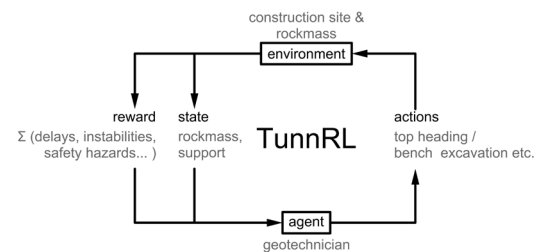
13:00  
Uhr

**Prof. Thomas Marcher, M.Sc. Georg Erharter**

*Rock Mechanics & Tunnelling, TU Graz, Austria*

Reinforcement Learning (RL) as a sub-branch of Machine Learning refers to the process in which an agent learns to achieve a specific goal by interacting with its environment. In the beginning a simple example is used to show which opportunities can also be transferred to tunnel construction through these techniques. The process of conventional tunnelling has many similarities, where a geotechnical engineer (agent) tries to achieve the completion of the tunnel structure (goal) by optimally excavating the rock mass (environment). We

present in this contribution a novel RL-based framework for strategy development for conventional tunnelling. By developing a virtual environment, the algorithm can choose from different tunnel excavation sequences to complete the tunnel excavation in the most economical and safe way. It is shown that the optimal goal achievement strategies have great similarities with current practices of conventional tunnelling. This approach offers great potential for the development of new tunnelling strategies.



## INNOVATIVE FIELD MONITORING TOOLS FOR BIG DATA ACQUISITION AND IMAGE-BASED DEEP LEARNING IN TUNNEL ENGINEERING

13:45  
Uhr

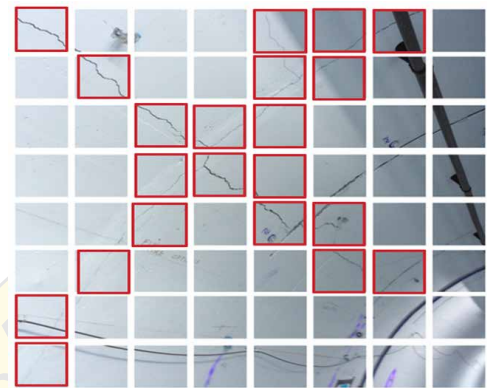
**Dr. Zili Li**

*Civil, Structural & Environmental Engineering, University College Cork, Ireland*

In general, the application of machine learning in geoenvironment still significantly lags behind e-commerce, social network and many other fields. One major challenge in geoenvironment is the lack of big data to train, test and validate machine learning models, as the acquisition of big geodata usually relies on manual site investigation, expensive lab testing, time-consuming field monitoring and etc.

including distributed fibre optic sensing, wireless sensor network, drone inspection and etc., which enable to acquire large amount of geodata at lower cost of labour and time than previously available. Specifically, an image-based deep learning of ageing tunnel infrastructure will be introduced in this webinar from data acquisition, data processing to automated tunnel defect classification and structural health assessment.

Considering the challenges in big geodata acquisition, this webinar will introduce a series of innovative field monitoring technologies,



## REAL-TIME ANALYSIS OF SOIL-STRUCTURE INTERACTIONS IN MECHANIZED TUNNELING USING ARTIFICIAL NEURAL NETWORKS

14:30  
Uhr

**Dr.-Ing. Ba Trung Cao**

*Structural Mechanics, RUB, Germany*

Currently, the steering of the tunnel boring machine (TBM) in mechanized tunneling is only based on measurement data and engineer experience. In this contribution, a simulation-based approach, which can support the advancement of the TBM in soft soils using soil-structure interactions as steering targets, is presented.

