Attention

MSc students!

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> Are you passionate about tackling real-world water and environment issues with new technologies?

Requirements

- **Enrolled in a relevant MSc program** software development, data science, earth observation, or innovative technologies for modeling or monitoring
- To facilitate collaboration with Dutch universities for our internship program, we encourage students who are currently enrolled in a Dutch university and residing in the Netherlands to apply.

Program duration is 6 – 9 months starting September 2024

Interning with Deltares means a monthly student allowance of €550 (depending on your study points), flexible working hours, and the chance to work alongside top researchers from a Triple A institute.

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Surrogate Modeling of Dike Wave Overtopping Based on ML/ Deep Learning Algorithms

The master thesis focuses on developing deep learning techniques for a dike overtopping surrogate model capable of accurately capturing turbulence-related temporal and spatial processes within computationally feasible timeframes. This facilitates subsequent use in probabilistic modeling. Dike overtopping failure mechanisms, driven by turbulence and erosion processes, pose challenges for detailed CFD-RANS computational models due to their extensive computational time and numerical stability issues. The surrogate model for wave overtopping is based on an existing CFD-RANS model of a dike constructed using OpenFOAM.

Contact
Vera van Bergeijk
vera.vanbergeijk@deltares.nl

Deep Learning Models for Computer Vision of Environmental Variables

The master thesis focuses on the methodology to support the processing of optical observations, which contributes to the development of the hydraulic laboratory of the future. Optical observations of the hydro-environment are increasingly recognized as a crucial data source for various processes, including the monitoring of plastics, floating vegetation, water flows, and hydraulic structures. To process this data effectively, robust and fast algorithms are needed to perform vision tasks such as semantic segmentation and object detection. These algorithms must be able to handle significant changes in lighting, deterioration of lenses, and environmental conditions.

One of the case studies involves the physics of macro-plastic transport in turbulent flow conditions, which aids in designing better solutions for intercepting or monitoring pollutant loads in water systems. These experiments typically involve releasing elements of arbitrary geometries, such as plastic bags, into controlled flow conditions, and analyzing hours of video imagery from various experiments.

Contact
Antonio Moreno-Rodenas
Antonio.MorenoRodenas@deltares.nl

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Advancing Salt Intrusion Models with Machine Learning Towards the Virtual Delta

Contact
Mo Wannasin
Mo.Wannasin@deltares.nl

The master thesis/internship study focuses on the untilization of machine learning techniques to improve model accuracy and computational efficiency for real-time chloride concentration prediction at critical locations in the Rhine-Meuse delta. This study is part of the 'Virtual Delta' project, which aims to develop a digital twin—a cutting-edge operational modeling toolbox that also aims to predict salt intrusion in real-time, considering extent (how far saltwater intrudes inland), concentration (how salty water becomes), and duration (for how long water becomes too salty above thresholds). This model is being enhanced by extending By integrating machine learning, Explainable AI, and meta-modelling, we expect to enhance existing models; (SOBEK (1D model), IMSIDE (2D model), and D-HRYDRO (3D model), through the integration of machine learning, Explainable AI, and meta-modelling. to assit water managers and stakeholders with a more accurate and expedient salt intrusion forecasting tool.

Utilizing Machine Learning for more Effective Dredging - case study of Port of Rotterdam

Contact
Erik Hendriks
Erik.Hendriks@deltares.nl

The thesis focuses on developing a machine learning model that provides new insights into the relationship between environmental variables and sedimentation volumes in ports. To maintain a safe navigable depth, dredging has to take place frequently. Therefore, the goal of this work is to enable more effective dredging in ports, ultimately leading to a reduction in greenhouse gas emissions.

The case study is the Port of Rotterdam, where local data is readily available. Each dredging trip conducted over the past years is documented in a database. You will combine this database with data from public sources and perform data processing. Ultimately, the machine learning model may be used to finetune dredging strategies and thus lead to more effective dredging operations.

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Application of Physics-Informed Neural Networks (PINNs) for Shallow Subsurface Characterization Using Dark Fiber Along Railways

Contact
Edwin Obando Hernandez and Eline Leentvaar
Edwin.ObandoHernandez@deltares.nl
Eline.leentvaar@deltares.nl

The master's thesis proposes the utilization of Physics-Informed Neural Networks (PINNs) for subsurface characterization through S-wave velocity inversion, particularly targeting shallow depths, as a means of monitoring ground instability issues along adjacent to railways. This approach proves particularly advantageous when leveraging dark fiber cables deployed over several kilometers, offering a large number multitude of measurement points that pose challenges for conventional S-wave inversion methods due to their time-consuming nature. Initially, the thesis suggests training and validating a PINNs model using synthetic S-wave profiles, subsequently applying it to predict S-wave velocity profiles based on existing dark fiber data. The project's outcomes will be compared with profiles obtained through standard inversion techniques, ultimately contributing to the advancement of an AI tool for shallow subsurface characterization. This tool holds relevance for linear infrastructure projects such as roads, railways, and potentially, levees.

Developing a text mining toolbox for retrieving global groundwater data

Contact
Jude King
Jude.King@deltares.nl

The master thesis aim to develop and implement text mining methods to extract structured information from unstructured literature related to groundwater and geology data. Text mining is a cutting-edge AI technology that can extract high-quality information from text. It uses natural language processing and machine learning methods to extract structured information from unstructured literature and makes semantic reasoning for knowledge discovery. Experts in groundwater modelling are involved to develop a generalized approach that can be applied to other parameters in future phases. Responsibilities encompass conducting literature reviews, analyzing existing text mining methodologies, refining parameterization, calibration, and validation of our global groundwater model through collaboration, and testing and validating developed tools against relevant datasets and benchmarks and finally documenting the workflow and presenting results.

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