4 PhD or Postdoc Positions at the Remote Sensing Technology Institute at the German Aerospace Center (DLR).

The department "EO Data Science" at the Remote Sensing Institute of DLR, located in Oberpfaffenhofen near Munich, develops advanced signal processing and AI techniques for current and future Earth observation missions. It is involved in a large number of third-party funded projects and a large international network.

In the context of our project work, we have **4 open scientist positions** to fill. The outcome of a PhD degree for these positions is foreseen.

Position "WeMonitor" - duration 3 years, starting as soon as possible:

The tasks to be worked on are directly relevant to the timely recording of changes on the entire surface of the Earth. Socially highly relevant examples are (illegal) waste dumps, landslides, deforestation, dam failures, fire, or volcanic activity. Due to their short time scales, these events have to be distinguished from seasonal long-term changes by precise analyses of the spatial as well as temporal domain. To accomplish this efficiently, the core task is scientific research on Artificial Intelligence for Earth Observation and the development of sophisticated, relevant Deep Learning (DL) algorithms. Project management is an equally important part of the task profile.

The DL model development tasks can be further broken down into
1. development of interactive data annotation methods for training weakly supervised DL models.
2. implementation of a transfer learning algorithm to benefit from parallels to other research fields regarding spatio-temporal models for anomaly detection.
3. development of an efficient method of multi-modal learning.

Due to the long experience of the Geoforschungszentrum Potsdam (GFZ) in the evaluation of satellite data and in the relevant scientific fields, the GFZ takes over the evaluation of the data products and the application of the models developed at DLR for **active learning**, model transfer, and evaluation and validation of the models. A close exchange with the GFZ is therefore indispensable.

Position "AutoCoast" - duration 3 years, starting as soon as possible:

Much of the world's coastal regions are undergoing severe changes due to either erosion or sea level rise. Due to the dense settlement of these regions, there is an acute need for action, especially to quantify the rate of change.

The AutoCoast project aims to achieve this by developing advanced, reliable AI algorithms based on high-resolution Earth observation data. Before the developed methods are applied globally, the Baltic Sea and North Sea will be used for study and validation purposes.

The project has two specific objectives:

1. classification of shoreline types based on multiple sensors onboard Earth observation satellites (e.g., sandy beach, cliff, wetland, ...) and quantification of rates of change.

2. identification of local causes of such changes using **Explainable AI**.

The partner Hereon will subsequently integrate the results into the marine geoportal "coastMap". The Helmholtz Center Hereon is an interdisciplinary center for coastal research. A close exchange with Hereon in the course of the project is indispensable.

Position "SURF" - duration 3 years, starting as soon as possible:

The tasks to be worked on are directly relevant to the rapid recording of flood damage after flood events - a highly relevant and explosive field of activity for the future. The core task is scientific research on the topic of Artificial Intelligence for Earth Observation and the development of sophisticated, relevant Machine Learning (ML) algorithms.

The main focus of the tasks is on.

1. developing an **unsupervised ML** model for change detection based on time series data from Earth observation satellites. The direct goal is to support flood management.

2. development of ML algorithms for segmentation of building footprints, especially for damaged buildings. This special case presents an additional challenge. An envisioned solution approach is to exploit manifold data from various sensors on board different earth observation satellites, as well as time series of these data.

3. develop a semi-supervised model based on the unsupervised ML model from point (1). Data annotation is a particularly costly challenge for change detection models based on time series data. The goal is to detect different patterns of change in different geographic environments. It must be assumed that pre-annotated data are scarce.

The evaluation of the data products and single case applications of the ML algorithms are driven by the Geoforschungszentrum (GFZ) Potsdam. A close exchange with the GFZ is therefore indispensable.

Position "Evoland" - duration 3 years, starting as soon as possible:

The abundance of Earth observation data from radar measurements, multi- & hyper-spectral imagery, and spaceborne LiDAR surveys provides ample opportunities to sense the surface of our planet.

An increasing amount of success stories proves artificial intelligence methodologies useful for remote sensing applications. Our team "Large-Scale Data Mining in Earth Observation" (DM4EO) applies state-of-the-art weakly-supervised learning to tackle real-world challenges such as accurate land surface mapping for the European Copernicus programme (https://land.copernicus.eu/global/products/lc)

under the constraint of limited amounts of labels available.

We invite motivated professionals with a Masters degree from physics, mathematics, data science, and geoinformatics to join our mission to advance scalable technologies with the aid of machine/deep learning. In particular, you would get familiar with data fusion and analytics of sensors such as DLR's EnMap satellite (hyper-spectral), ESA's Sentinel-1/2 missions (radar and multispectral), and NASA's GEDI instrument (spaceborne LiDAR). Given coding skills in Python, preferably with initial expertise in the PyTorch framework, you will perform research in novel

methodologies to improve semantic segmentation for land cover monitoring such as forests and agricultural land. More specifically you will tackle challenges in spatio-temporal data fusion for change detection from a plurality of satellite sensors with the aid of self-supervised learning.

Besides your affiliation with DLR, your project offers opportunities to interact with relevant European governmental and private institutions such as the French Space Agency, Vito (BE) and GAF AG (DE). Moreover, DM4EO actively seeks collaboration with overseas, among: IBM TJ Watson Research Center, NY and the World Bank in Washington, DC. You will acquire expertise in deep learning research for computer vision in the geosciences. You will not only conduct application-relevant science, but your skill set is going to adopt industry-standard coding for future track record in either academia or industry.

Qualifications for all positions:

- Completed scientific university studies (university diploma/master) in computer science, data science, geoinformatics, geodesy, physics, or comparable disciplines

- Mature programming skills in Python with hands-on experience in PyTorch

- Experience in machine learning (ML) and big data handling.

- Ability to clearly dissect the essence of mathematical methods and numerical algorithms

- Experience in computer vision and remote sensing is an advantage

- Very good knowledge of the English language, both written and spoken

- Strong internal and external communication and collaboration skills

- Ability to interact with scientists at different levels

- Ability to work both independently and as part of a highly motivated team

Please send your full application (motivation letter, CV and certificates) with mentioning your favorite position to **ai@dlr.de**