Master thesis: Determining Site Conditions for Bifacial Photovoltaic Power Plants from Satellite Data

Stellenanbieter: Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR)

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Enter the fascinating world of the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) and help shape the future through research and innovation! We offer an exciting and inspiring working environment driven by the expertise and curiosity of our 11,000 employees from 100 nations and our unique infrastructure. Together, we develop sustainable technologies and thus contribute to finding solutions to global challenges. Would you like to join us in addressing this major future challenge? Then this is your place!

The Energy Meteorology Group collects meteorological data and identifies parameters essential for the design, operation, and qualification of solar power plants. The team has developed software tools to measure and forecast solar irradiance, analyze solar module soiling and determine other parameters such as albedo using ground-based cameras and satellite data. With our research facilities in Almería in southern Spain we accelerate the development of practical solutions with a focus on sunny climates together with our Spanish partners.

Your mission:

Accurate information on site conditions, such as solar radiation and ground reflectance, is required throughout the life cycle of a solar project. This data enables optimal design, evaluation and performance of solar power plants. Satellite-based, partially modelled data and ground-based measurements of varying quality are commonly used data sources.

The focus of this work is on bifacial photovoltaics (PV). Bifacial PV is a technology that also converts the irradiance received on the rear side of the module into electricity. This way, the production increases by 10-20% compared to monofacial PV plants. To plan and operate bifacial PV plants efficiently, improved site data is crucial. The aim of this research is to use high resolution satellite data (30 cm) to determine ground reflectance/ albedo and the irradiance received on the rear-side of PV modules with high accuracy and low cost.

The focus of the Master thesis can be adapted to your profile. A focus can either be set on the more phyical or on the machine-learning tasks.

Your tasks will be:

- You will apply machine learning techniques to analyze satellite images, detect PV modules and retrieve the spatial distribution of ground conditions (including ground

reflectance) at existing power plants and potential sites.
- You will develop a dedicated machine-learning model and an innovative training procedure which reduces the need for manually labeled reference data.
- You will analyze your results and optionally evaluate the practical benefits of the developed method for solar energy applications.
- You will implement state-of-the-art methods to receive ground properties from satellite data and compare your method to these prior ones.
- You will collect and prepare satellite data for training and testing your models.
- Contribute to the labelling of reference data.
- Summarize your methodology, experiments and results in a well-structured Master's thesis.

We've got a great offer for you:

- A collaborative, diverse, and motivated team committed to building a sustainable future.
- Opportunities to work closely with colleagues and tutors, exchanging ideas and solving challenges.
- Hands-on experience in machine learning and software development.
- Exposure to cutting-edge technologies in image processing, computer vision and machine learning.
- A chance to contribute to climate change mitigation and advance renewable energy solutions.
- Gain international experience working at a leading European research facility's office in Almería, Spain, a sunny city on the Mediterranean coast.

Your qualification:

- You have a good academic record in a Master's/Diploma program in the fields of geoscience, energy technology, engineering, physics, or similar.
- First experiences in Python and basic knowledge about machine learning would be appreciated.
- Basic knowledge in the field of satellite imaging or remote sensing would be appreciated but not necessary
- The ability to work independently and collaborate in an international team.
- Confident in speaking and writing English.
- Prior experience or interest in data analysis, computer vision, software versioning systems, photovoltaics, solar energy or solar radiation is an advantage.

If this sounds like an exciting opportunity for you, please contact us! Dr. Niklas Blum (niklas.blum@dlr.de + 49 2203 6014 478). Please enclose supporting documents for the above points with your application.

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Ursprünglich veröffentlicht: 21.01.2025

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