Title: Deep Neural Network for Global Horizontal Irradiance (GHI) Prediction

Summary: *We are seeking a talented and motivated student to join our research team for an exciting master's project focused on advancing the field of solar energy prediction using deep learning techniques. The primary objective of this project is to further develop a deep neural network (DNN) for accurate Global Horizontal Irradiance (GHI) prediction by incorporating additional image data and meteorological information.*

The student will be responsible for expanding and optimizing the existing DNN model for image processing, specifically tailored for GHI prediction. The project will involve collecting and preprocessing a larger dataset of images captured by webcams, along with relevant meteorological data such as temperature, humidity, and wind speed. The student will need to demonstrate a strong understanding of machine learning and deep learning concepts, as they will be implementing and fine-tuning the DNN architecture.

Key Responsibilities:

1. Review the existing literature on deep learning methods for solar energy prediction and image processing techniques.
2. Enhance the existing DNN model for GHI prediction by incorporating additional image data and meteorological variables.
3. Collect and preprocess a diverse dataset of satellite and/or webcam images, along with corresponding meteorological data.
4. Implement and fine-tune the DNN architecture using suitable deep learning frameworks.
5. Conduct rigorous experiments to evaluate the performance of the enhanced model against benchmark datasets.
6. Analyze the results and provide insights into the effectiveness and limitations of the proposed approach.
7. Document the research methodology, findings, and recommendations in a comprehensive report.

Requirements:

- Solid understanding of machine learning and deep learning concepts.
- Proficiency in programming languages (ideally Python) and experience with deep learning frameworks (e.g., Keras-TensorFlow, PyTorch).
- Familiarity with image processing techniques and relevant libraries (e.g., OpenCV).
- Strong analytical and problem-solving skills.
- Ability to work independently and collaboratively in a research-oriented environment.
- Excellent written and verbal communication skills.

This master's project offers an excellent opportunity for the student to deepen their knowledge and skills in machine learning, specifically in the context of deep neural networks and image processing. By working on this project, the student will contribute to the development of cutting-edge techniques for solar energy prediction, addressing the challenges of GHI estimation. The project outcomes will have practical implications for renewable energy planning, grid integration, and optimizing solar energy resource management.

The student will be mentored by Prof. Christophe Moser (christophe.moser@epfl.ch) and will receive ongoing support from Roy Sarkis (PhD student, roy.sarkis@epfl.ch). Additionally, there will be opportunities for publishing research findings in reputable conferences and journals. This project will provide valuable hands-on experience in AI-driven renewable energy research and contribute to the advancement of sustainable energy solutions.