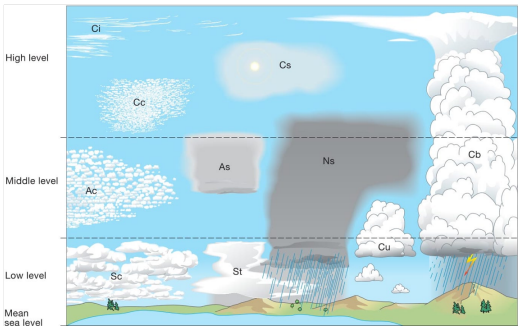
Bachelor / Master Thesis

Dynamic Cloud Nowcasting using Artificial Neural Networks

Course of study:	Mathematics, Computer Science, Computational Engineering
Kind of thesis:	Programming, Simulation, and Optimization
Programming language:	Python
Start:	Winter term 2019/20

Topic

The goal of the project is to predict the cloud-induced shadow building on mirrors of a solar thermal power plant. As input we assume one stereoscopic cameras to be located on the ground at the center of the solar field taking pictures of the sky. From these images, we aim to directly compute the current positioning of clouds. With the knowledge of the position of the sun, the cloud shadow on the ground can be computed. If we furthermore know the speed of the clouds, we can predict when and where the clouds will shadow the mirrors. For better predictions of cloud-induced shadows on the solar mirror field we aim to learn the problem end-to-end with the help of an artificial neural network. Thus, as input we use a time series of stereoscopic pictures. As output we aim to directly predict the binary information on which parcel of land there will be shadow.



Tasks

The following tasks have to be solved:

- Extend an existing convolutional neural network (CNN) for the static case by pre-processing the input image. Remove effects of camera distortion.
- Revise the existing 3D model, which considers now two cameras (lenses, focal points of fisheye), position of the sun (azimuth and altitude angle), cloud movements (height, shape, variable speed, variable moving direction).
- Generate a training set of fisheye camera images at different instances of time, sun position, and corresponding binary shading matrix in a future instance of time as label.
- Learn the dynamic scenario. Here, we aim to apply a RNN. Investigate whether it is better to train an RNN from scratch or to reuse the CNN trained for the static case via weight initialization.
- Compare different architectures for the neural network (LSTM, GRU).

Contact This project is offered by the *Theory of Hybrid Systems* (i2) research group headed by Prof. Dr. Erika Ábrahám and will be co-supervised by Dr. rer. nat. Pascal Richter. For further questions please contact us via email:

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