9.19 EVALUATING THE ACCURACY OF OPTICAL FLOW TECHNIQUES ON NOWCASTING

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Optical flow (OF) techniques estimate the motion of objects or fields from a sequence of images. Such methods have been applied in the context of precipitation nowcasting for some while, using the weather radar reflectivity field or rainfall intensity as input, and have shown skill for lead times up to several hours.

In this study, we analyze the behaviour of the Sparse OF technique according to the Lucas-Kanade method implemented in the OpenCV library. Specifically, we benchmark different implementations of an intermediate step in the entire nowcasting procedure, namely the prediction of detected feature locations.

For that purpose, we detect trackable features (corners) in subsequent images, and then extrapolate their movement from forecast time t(0) until lead time t(n). The predicted feature location at t(n) is than compared to the true feature location at t(n). With "true", we refer to the feature location as detected and tracked in the observed radar images from t(0) until t(n). The error of the predicted feature location will be expressed as the Euclidean distance between the true and the predicted feature location.

In our benchmark experiment, we will analyse the predictive skill at various lead times, based on different methodological variants that differ with regard to the maximum number of detected features, the neighbourhood of a predicted feature, the number of radar images considered before t(0), and statistical extrapolation approaches of various complexity.

The experiment will be based on weather radar data from the German Weather Service, namely the the RY product, which represents a rainfall intensity composite for the whole of Germany at 5 minute intervals and a spatial resolution of 1km^2, covering 900 x 900 km. The workflow is put together entirely based on open source Python libraries, namely NumPy, SciPy, OpenCV, matplotlib, and wradlib.