Exploiting embedding representations to characterize severe storms over the Alpine region using MSG/MTG data.

Severe thunderstorms play a crucial role in the expected damages due to climate change and floods that EU will have to face in the 2050s. These systems, especially in the Alps, produce heavy rain and cause landslides and flash floods. Orographic forcing triggers convection at the Alps' foothills, and clutter induced by mountain chains make ground-based observations by weather radars challenging. Satellite observations represent thus a useful alternative tool for monitoring high-resolution natural hazards over the Alpine region. Moreover, only satellite images can reliably identify the early stages of convection.

Recently, ML techniques showed exciting developments in cloud pattern identification from satellite images. In particular, recent works adopted a self-supervised approach that distinguishes cloud systems in MSG data using embeddings. Embeddings identify common semantics in images and locate them together in the output space of the computational model.

In this work, we focus our efforts on the Alpine region extending from South Germany to the Appenines, an area well known for severe storms. We aim at identify typical patterns leading to severe events and characterize the environmental conditions in which they develop. We use cloud optical depth images retrieved from MSG/MTG data using convolutional neural networks (CNN) as a deep learning architecture. The ML embedding technique based on self-supervision used in this study was recently developed for analysing satellite data from Atlantic and Germany. The computational model reveals representations needed for the classification of the raw data by learning features from labeled data. Labels are constructed by matching input label pairs of each data point and achieving learning with some gradient descent.

We present in this work preliminary results and possible application of the technique as a new framework for model evaluation.