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Gale Warning for Swiss Lakes and Regional Aerodromes based on Ensemble Genetic Programming

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Switzerland counts about 60 lakes and aerodromes for which warnings are issued in case of high probability of wind gusts exceeding 25 knot. Mitigating actions can then be triggered accordingly, on a local basis. These warnings being not automated, forecasters are required, beside their main duties, to pay attention round-the-clock to the local weather evolution at these many specific locations. Not surprisingly, quality assessment demonstrates low efficiency, with frequent missed events.

This project is aimed at implementing a semi-automatic gale warning system based on an evolutionary algorithm, also called genetic programming, initially developed in collaboration with the Artificial Intelligence Laboratory of the University of Zurich. The system delivers precursory proposals for gale warnings, supporting forecasters in their ongoing weather surveillance. Working on a predictor set specific to each lake or aerodrome (in each case, 4-year data of relevant observations and short-term forecasts from the 2-km numerical weather model COSMO-2 run by the Swiss National Weather Service MeteoSwiss), the evolutionary algorithm constructs, evaluates, selects and improves algorithmic expressions - indeed Java methods - aimed at forecasting maximal gust intensity within the next hour. 20 such evolution runs are performed, leading to an ensemble of 20 methods specific to each warning object (lake or aerodrome).

In operational practice, the 20 methods of each warning object are evaluated every 10 minutes and deliver probabilities of gale occurrence that are displayed as warning suggestions if exceeding a pre-defined threshold. The forecaster must at the end either confirm or reject the alarm.