CZECH-UNDP
PARTNERSHIP
FOR THE SDGS

Computer Vision Flood Forecasting using Remotely Sensed Data -Bregava River-

gisat

CZECH REPUBLIC
DEVELOPMENT COOPERATION

UNDP

HYDROINFORMATICS INSTITUTE BALKANS
d.o.o. Sarajevo

Motivation

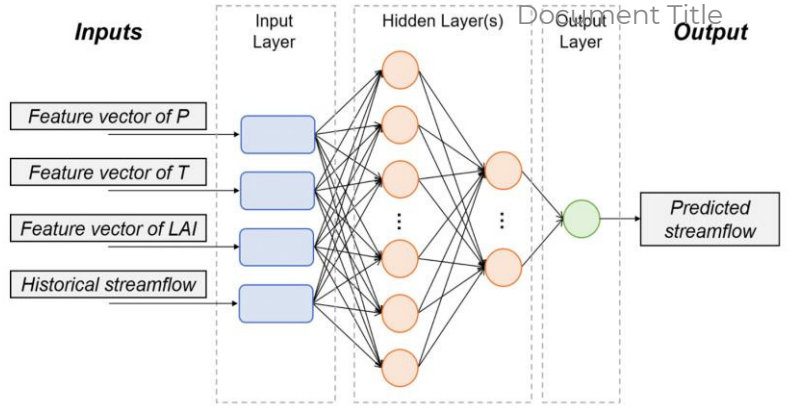
Regional flood forecasting and modelling is an old yet largely outstanding problem in the hydrological sciences. The problem is even more pronounced in Bosnia & Herzegovina due to inadequate hydrometeorological monitoring network. According to FHMZ, there were more than 500 well-functioning rainfall stations before the war, while at the present less than 100 remain operational.

Approach

The approach adopted in this project was to extract information relevant to rainfall–runoff behaviours from remotely sensed observable catchment attributes. The intention is to use deep learning to map meteorological time series into streamflow that itself depends on a set of static catchment characteristics and dynamic meteorological properties. The final product is available as a web-service enabling seamless access to data and flood warning system through the cloud.

Case Study

To demonstrate the approach, an implementation of the data fusion framework has been implemented at Bregava Catchment. Bregava belongs to the Neretva river basin. The estimated catchment area of Bregava River is 720 km2. It is equipped with 2 meteorological stations and 2 hydrological stations.



This project considered precipitation (P), temperature (T), and LAI data fields as the inputs of the data-driven models

The performance and methodology relevance were tested on Bregava catchment (BiH) and based on the experience several conclusions may be derived:

- EO data represents freely available and affordable data source w

inevitable advantages (but also limitations)

- Near real-time (NRT) availability, standardized and automatized

processing, suitable for large scale application (consistent and comparable results over the whole area of interest), fine spatial resolution and high temporal resolution, certainty of continuity in future (key aspect of operational use), data used are freely available significantly reducing costs, Sentinel data proved to be a suitable data source of key variables as LandCover and vegetation characteristics as LAI

- For ERA5 Land data, the availability is not fully NRT, represents

modelled values and not direct measurements but provide very high temporal resolution (hourly data), spatial resolution is too coarse for small scale catchment with limited influence compared to averaged approach (may be of less significant for large catchments and bringing additional spatial heterogeneity input in the modelling process), alternatives are available but with similar characteristics as temporal and spatial resolution

- EO data flood forecast modelling based on the results seems to i

high potential of EO data for hydrological forecast. Considering low relevance of coarse spatial resolution of meteorological inputs exploring avenues for finer spatial data coverage may be provide additional opportunities.

- Follow-up activity in form of a web-based operational forecast w

the use of machine learning would provide efficient means for dissemination of forecast

- Additional advantage is continuous learning from data when app

on long term time series of data

- The approach developed under the project provides two fundamental benefits compared to more traditional approaches. The first benefit is accuracy. The machine learning approach introduced here provides unprecedented accuracy of river flow forecasts with forecast lead times of 3 days (72 hours). Second benefit is latency, since the approach introduced here relies on data collected in-situ and available at higher temporal frequency, it is now possible to provide updated forecasts on hourly basis. Finally, modelling was performed within area with very low number of meteorological and hydrological stations, which significantly limits of complex hydrologic-hydrodynamic approaches application in such area.