ERCIM fellowship Programme
Final scientific report

Fellow	Arbia Soula

Host Organisation	Institute of Technology and Software Engineering, "Jose María Troya Linero" Ada Byron Research Building, University of Malaga

Scientific coordinator	PEDRO MERINO GOMEZ /ALMUDENA DIAZ ZAYAS

I – SCIENTIFIC ACTIVITY DURING YOUR FELLOWSHIP

Working closely with my scientific coordinators, have been an immensely rewarding experience. Our collaborative work on various projects has deepened my understanding and fostered a strong sense of achievement and fulfilment. I actively contributed to the following research objectives:

- **Applying Artificial intelligence technique with sensor data assimilation in estimating crop water stress index for irrigation water management.**

  I investigated the vegetation index Normalized Difference Vegetation Index (NDVI) measurements derived from remote sensing data to detect the water status of plants.

- **Exploring the potential of deep learning-based approach to predict short and large-scale fluctuation of NDVI for a monitoring of vegetation activities using Meteorological and soil moisture datasets.**

  Changes in an environment such as drought do not always result in vegetation drought stress as vegetation responses to the climate factors involve complex processes. Therefore, satellite-based vegetation index NDVI carry information for understanding past and current vegetation circumstances and along with sensors-based climatic factors information aid to model vegetation dynamics to make future predictions.
  This study aims to evaluate the effectiveness of deep learning model Bidirectional Long Short-Term Memory model BiLSTM to predict vegetation activities via reproducing NDVI based on meteorological and soil moisture datasets. The ssequence processing model can predict NDVI by establishing the relationship between meteorological parameters and vegetation activities.

- **Introducing a combining deep learning approach BiLSTM with CNN for vegetation health assessment.**

  Climate change is the main influence factor of vegetation health, water cycle, soil and agricultural production. The Vegetation indices derived from remote sensing data are indicative of vegetation stresses over large geographical land surface. I have introduced a deep learning model to predict the impact of droughts in Spain's vegetation based on the NDVI derived from MODIS13A2, and temperature, humidity, air temperature, precipitation and soil moisture data from NASA's MERRA and NASA's YGNSS_L3 respectively. Our deep learning model predicts the generalized NDVI of vegetation and seasonal cycle correspondent to activities that are useful for monitoring and detecting water stress in vegetation.

II – PUBLICATION(S) DURING YOUR FELLOWSHIP

I'm going to prepare a paper on Deep Learning-Based technique to predict Large-Scale dynamics of Normalized Difference Vegetation Index NDVI for the Monitoring of Vegetation Activities and Stresses Using Meteorological and soil moisture Data.

III – ATTENDED SEMINARS, WORKHOPS, CONFERENCES

ERCIM Spring meeting in Málaga

IV – RESEARCH EXCHANGE PROGRAMME (REP)

In Research Exchange Programme, I visited CNR in Pisa, Italy, under the mentorship of lecture / Assistant Professor in Computer Science Alessio Ferrari and Dr Mino Sportelli. The duration of REP was 9th-13th September 2024. This experience was immensely enriching, offering valuable insights and discussions that greatly benefited my research.