IMPPeach – Harvest Prediction for Canned Peaches

Summary

Background

- Uncertainty of **harvest times and yields** affects **production** (planning and execution) and **marketing** (strategy, targets) of **fruit canning businesses**.
- Harvest dates and yielded quantities fluctuate from year to year due to continuous changes in the crop-soil-environment system: Different **weather conditions**, **diseases**, changes in suppliers/**farmers capacity and farming practices**.

Main project characteristics and activities

- **Large scale** (**100km2**) study of peach orchards, ~**2000 fields** / **>5000Ha** with canned peach varieties, more than **1000 farmers** in the area of Imathia/Central Macedonia/ Greece, cultivated by producers-members of 3 coops and supplying the canning facility of the project partner ALMME.
- Development of **Prediction Model** by employing AI/ML and statistical methods based on:
  - Historical production (yields) records per field and variety.
  - Remote sensing (image time series and vegetation indexes) data
  - Climatic, soil and cultivation data through both an IoT sensor network and field scouting.
- **Prediction model evaluation** and refinement over a 3-year period.
- **Integration** of model and data into a distributed **FMIS** between farmers, coops and and the fruit canning business's production planning.
- **Dissemination, communication and exploitation** including a study on how the project results can be transferred to other crops and geographical locations.

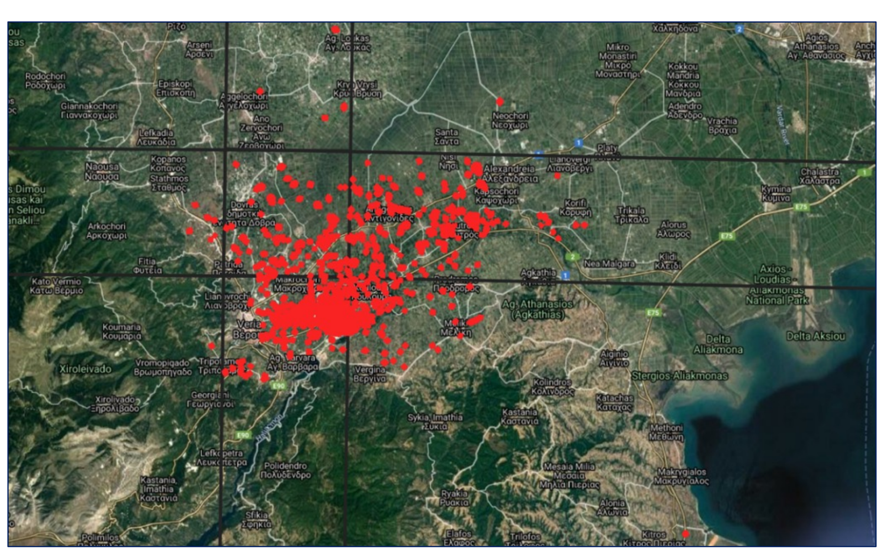

Figure 1. Overview map of ALMME peach fields.

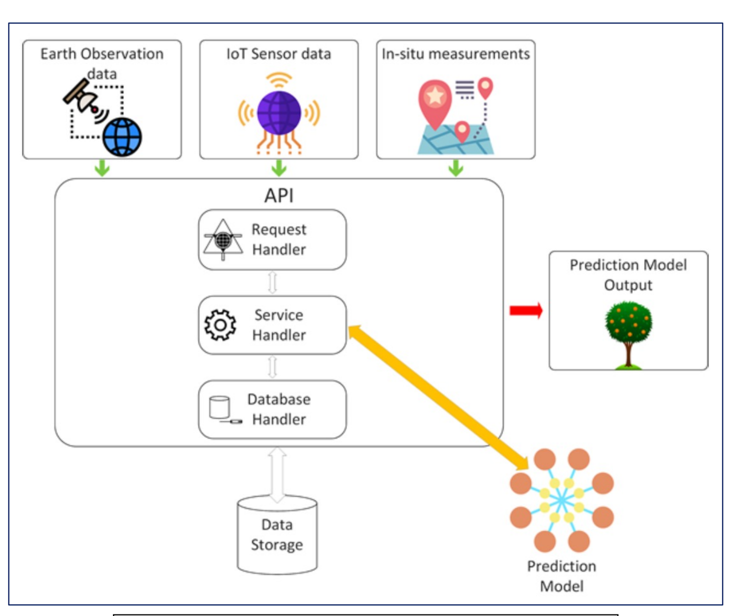

Figure 2. Platform architecture

Main objective/research question

- The IMPPeach project's primary objective is to **deliver accurate prediction of yields / quantities and harvest dates** for optimum maturity of peach cultivations (canned peaches varieties) using **a large-scale (area vs orchard) data-driven approach**.
- The **benefits** from improved harvest and yield prediction accuracy include
  - a) increase in production efficiency
  - b) added value for the products
  - c) more efficient and targeted marketing / gains in market share and
  - d) increased profit margins.

  These benefits affect not only the canning business itself but are shared with all stakeholders including a larger number of smallholder farmers / suppliers.

Preliminary results

- Collection, processing and geo-referencing peach production data (deliveries to facility) from 2017-2022 per farmer, field and variety. Datasets loaded into the FMIS.
- Scientific Review of the yield and time estimation modelling for peaches and similar fruits.
- Remote Sensing and Weather data geospatial platform developed with necessary APIs for the FMIS and loaded with the production data
- IoT sensor installation (40 pilot fields) in progress
- Prediction Model development in progress

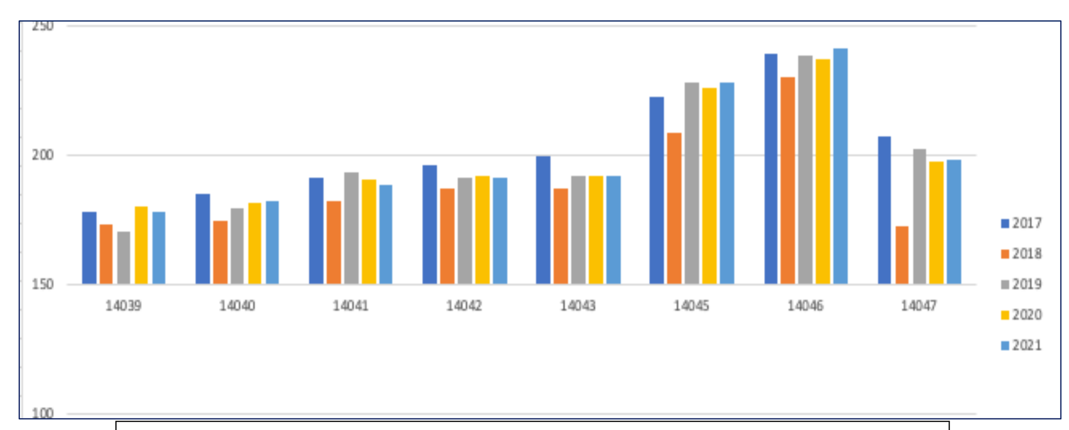

Figure 3. Harvest start Day of Year (DoY) per variety

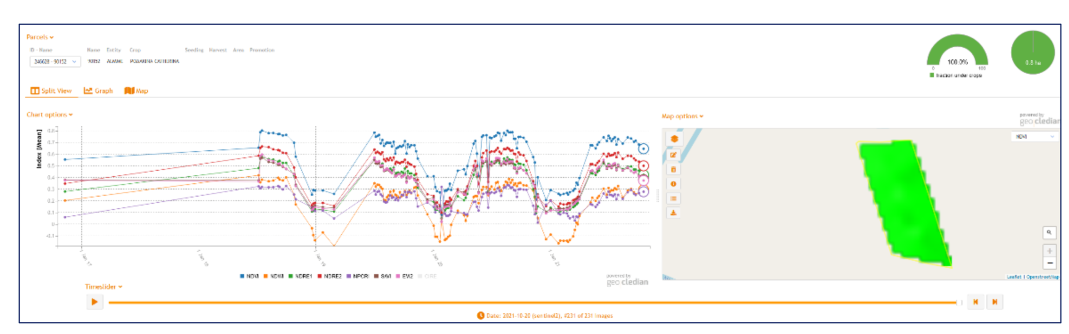

Figure 4. Multiyear time series showing several vegetation indexes for a parcel

Preliminary conclusions/ potential impact

- Data-driven approachess to digital agriculture require the availability of high-quality data sets. Farmers, cooperatives and Ag businesses must invest in the collection and curation of data from the farms.
- Analysis of historical production / harvesting records show that harvest start dates correlate with year across varieties, supporting the hypothesis that **climatic conditions during the cultivation period can be used to predict harvest time**.
- Sentinel-2 analysis showed that pixels with an assumed peach blossom have a lower chlorophyll-related vegetation index (NDVI, CIRE, SAVI, EVI, etc.) but a higher reflectance in the shortwave infrared (SWIR) spectrum which fits to the reported literature. **Blossom date detection** can be combined with established **GDH30** methods to derive harvest prediction models.
- The development of a data-driven harvest prediction model not only will offer the benefits of a more accurate production discussed above, but also will **motivate and educate farmers on the value of collecting data from their farms and documenting farming tasks**.

Future research activities

- Build and evaluate and harvest prediction models based on statistical and ML techniques based on the collected data (production history, Remote sensing time-series images and indexes, climate data).
- Iterate model development and evaluation for season 2022 and 2023 incorporating, for the last season, data from the field (IoT) sensors.
- Integrate model prediction to FMIS and Facility production planning.
- Model transferability study on other crops and locations.

Topic 1: Data-driven ICT platforms and solutions to improve the sustainability of agri-food Systems

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