

CITIZEN SCIENCE



CONFERENCE

14.–15.10.2020

Knowledge for Change: A decade
of Citizen Science (2020–2030)
in support of the Sustainable
Development Goals



HI-TERRA | Broaden your insights of drops.

Presenter: Gülşen Otçu

Hitsoft R&D Center

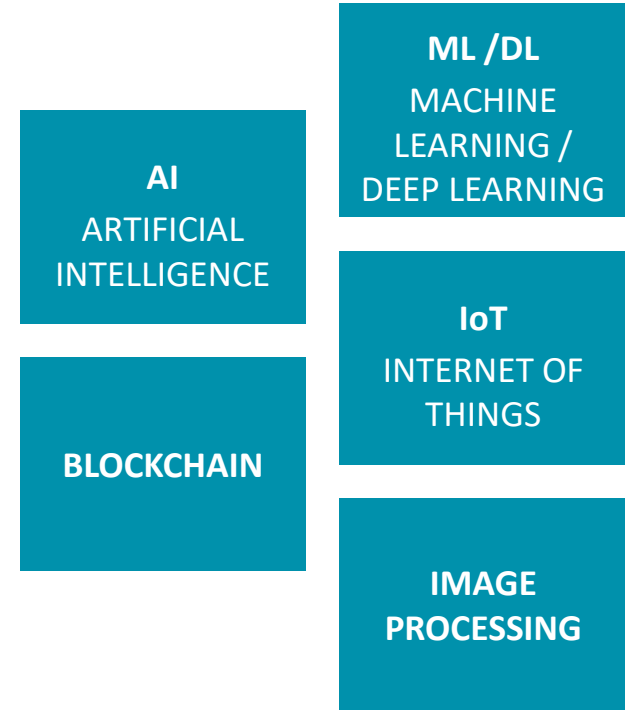
What we do

Developing future technologies

- › Growing since 2019
- › 5 completed ML, DL, blockchain projects
- › 2 on-going ML projects

Creating value

- › University-industry collaborations
- › Qualified human resources
- › Growth and expansion on R&D
- › Training activities and young talent scouting.



Hitsoft R&D Team

WeObserve ODC Challenge

- ›We produce technology and do deep learning to create a sustainable future.
- ›We aim to lead more resource efficient society and businesses.



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HI-TERRA: Soil Moisture Forecast Solution

An Intelligent Infrastructure



Quick. Easy. Reliable Soil Control System

Hi-Terra transforms GROW field sensor, weather condition and soil characteristics data into meaningful insights about soil moisture

- › Helps to minimize artificial watering
- › Uses machine learning and deep learning technology in agricultural practices
- › Creates dynamic forecasts for 24-hr
- › Warning system for critical levels, important weather conditions or anomalies.

Objectives of HI-TERRA



- Model soil moisture
- Forecast soil moisture



- Create societal and sustainability impact



- Soil, field, crop health
- Optimize water use



- Data-driven agriculture
- Smart resource use



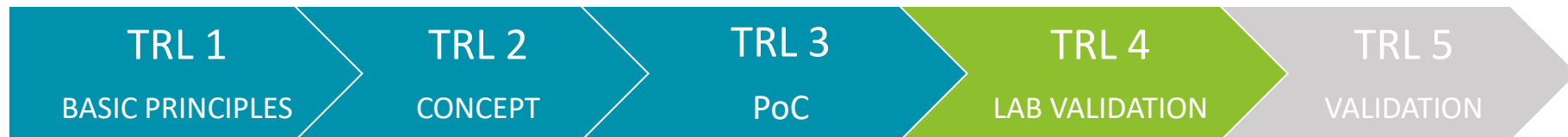
- Dynamic learning -LSTM
- Intelligent infrastructure



- Climate action
- Tackle SDGs

Current Stage of Development

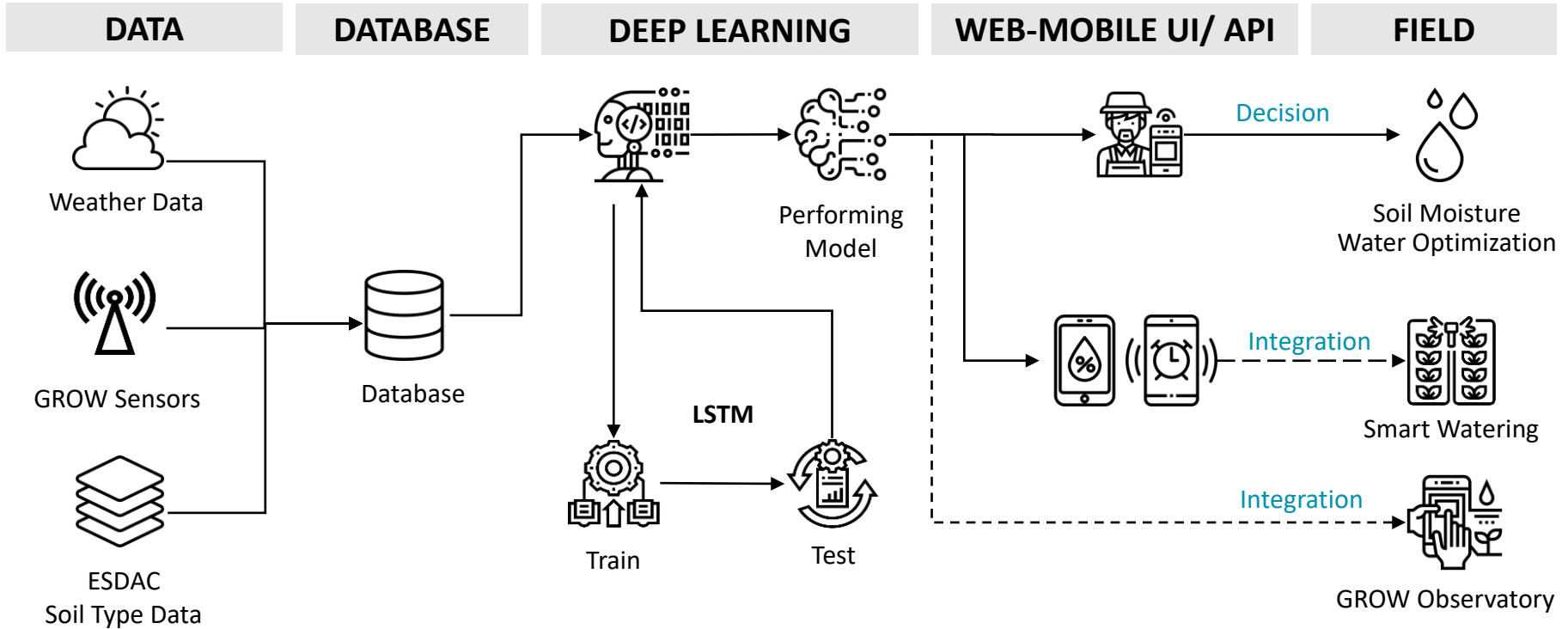
HI-Terra Roadmap



ACTIVITIES	Dataset selection New datasets Feature selection Idea creation Research about soil moisture and related parameters for water use Concept draft	GROW Data normalization Pre-processing Feature extraction Weather data integration Elaboration of use cases and application span User group selection Market analysis	Apply deep learning using LSTM model Train and Test Model soil moisture Improving accuracy Consolidate use-case and user groups Application scenarios Evaluation of potential	Analysis of soil datasets Improve model by using new data sets of soil type/ characteristics More train and test Improve accuracy Consolidate cases Consolidate stakeholder plans	Apply pilot platform to make a show case Observe real-world condition and get results Develop UI /integrate Improve and consolidate the concept
	Top-down Bottom-up approach	Deep Learning method	Deep learning LSTM	<i>On-Going</i>	Improvement

What is HI-Terra?

The concept and how the system works.

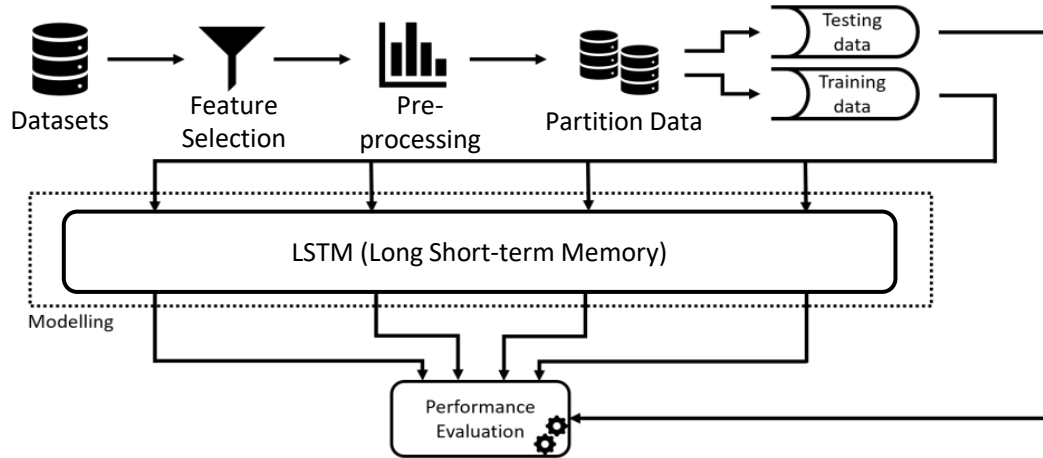


Our Methodology

Deep learning in core



- › Deep learning algorithms can reach conclusions as humans would by continually analyzing data with a given logical structure.
- › Long short-term memory (LSTM) architecture which is a special kind of artificial recurrent neural networks (RNN) and capable of learning long-term dependencies.



GROW Dataset and LSTM - I

Open-source Data use for HI-TERRA



Datasets

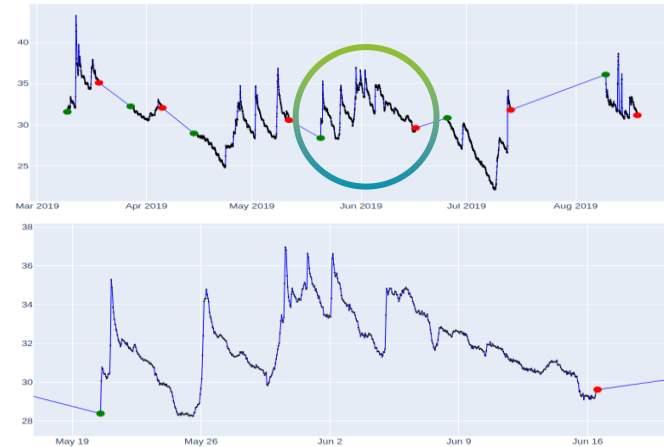
GROW
Soil Condition Dataset

DarkSky
Weather Data

ESDAC Soil Database
Available Water Capacity (AWC)

Pre-processing

- Sensors were closed at some intervals
- Split the time-series data into chunks; work in chunks



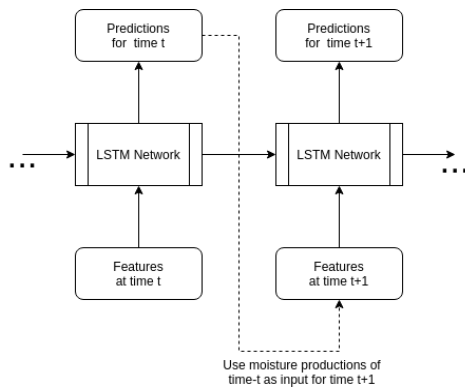
GROW Dataset and LSTM - I

Open-source Data use for HI-TERRA



LSTM Modelling

- LSTM has an internal state that is updated at each time-step with new features



Experiment Setup

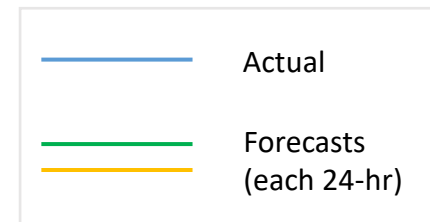
- Train and Test

	Train	Test	All
# of Locations	1000	274	1274
# of Chunks	3086	881	3967
# of Hours	1392707	388448	1781155

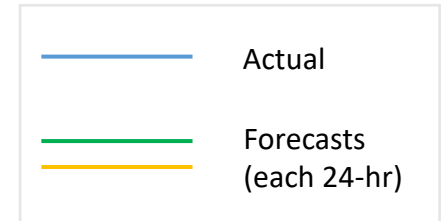
LSTM Modelling Results: Soil Moisture Forecasts - I



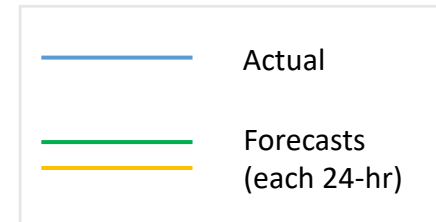
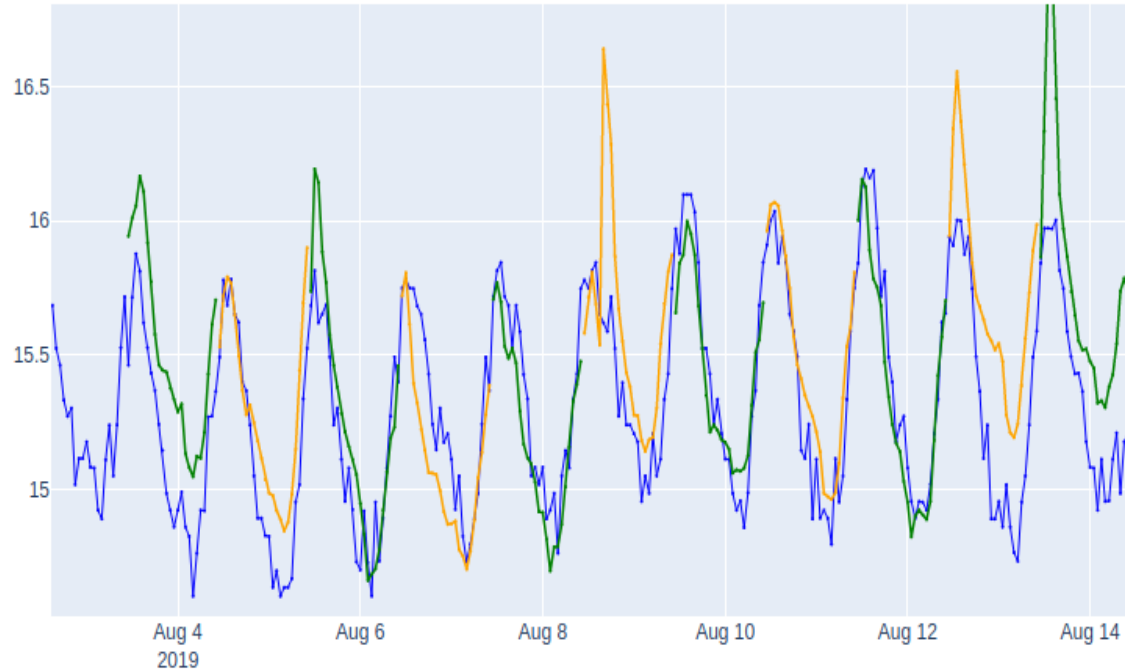
24-hour periodic forecasts
MAPE score: 7.5%



LSTM Modelling Results: Soil Moisture Forecasts - II



LSTM Modelling Results: Soil Moisture Forecasts - III

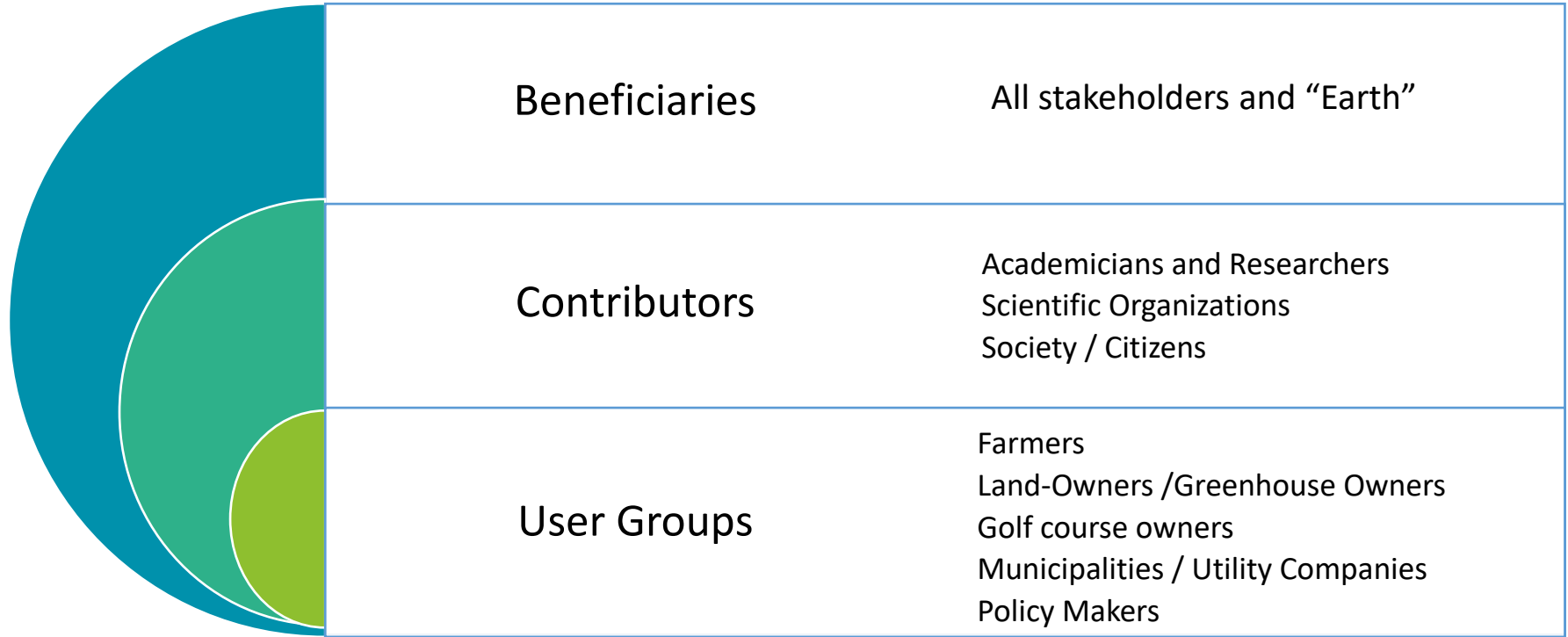


HI-Terra Use Cases



Stakeholders

User Groups, Beneficiaries and Contributors



Sustainability of Hi-Terra Solution



Advantages

Benefits of Predictive Soil Moisture Infrastructure



- ›Tackles societal challenges on climate, food, land and resources, related to SDGs
- ›Learns from multi-dimensional datasets (sensor, soil, weather data)
- ›Open to perform better by improving LSTM model and learn iteratively.
- ›Open to scale up, expand and integrate system to be an infrastructure
- ›Predictions with high accuracy
- ›Helps to save water and optimize watering periods
- ›Sustainable, collaborative and contributing system for our common future



Next Steps to Contribute More

How we will support citizen science



- Add Land Characteristics Datasets
- More Soil Property Data



- Contribute Citizen Science
- Open source



- Higher Accuracy /MAPE
- Improve Model



- Address climate action, food and land use challenges



- Forecast “How much water to be used” for irrigation



- Measure results
- Determine societal impact

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SDG CONFERENCE

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