SMART AGRICULTURE SOLUTIONS USING MACHINE LEARNING ON SENSOR NETWORK DATA

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MOTIVATION

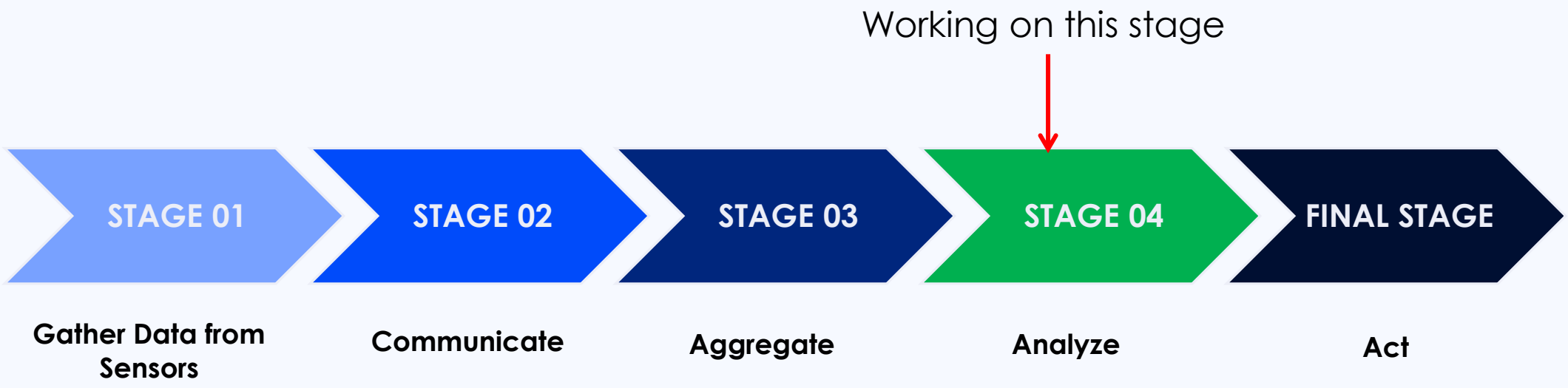
Less Productivity in Agriculture Sectors(50 % workforce contributes 16% to the GDP).

Growing needs due to ever growing population

Lab tests are expensive, time consuming and generally not feasible for farmers.

IoT sensors can be used to measure gather data in bulk which can be analyzed using various AI techniques for increased productivity and quality.

LEVELS IN IOT



OBJECTIVES

Reconstruction of missing data

Evaluation of Irrigation Water Quality

- ✓Prediction of WQI
- ✓Classification based on WQI

DATASETS

Water Quality Dataset

Weather and Soil Sensor Data

Parameters Used

Water Quality Dataset

Data gathered by various underwater sensors and lab tests by Indian Government under NWQMP from various water bodies.

- Temperature
- Total Dissolved Oxygen
- PH(Potential Hydrogen)
- Electrical Conductivity
- Biological Oxygen Demand
- Total Nitrate(NO_3^-)
- Fecal Coliform
- Dissolved Oxygen

Parameters Used

Weather and Soil Sensor Data

Soil and weather parameters measured by USDA, Agricultural Research Service

Air Temperature	Relative Humidity	Water Vapour Pressure
Dew Point Temperature	Wind Speed	Wind Direction
Incoming Solar Radiation	Relative Soil Moisture	Soil Temperature

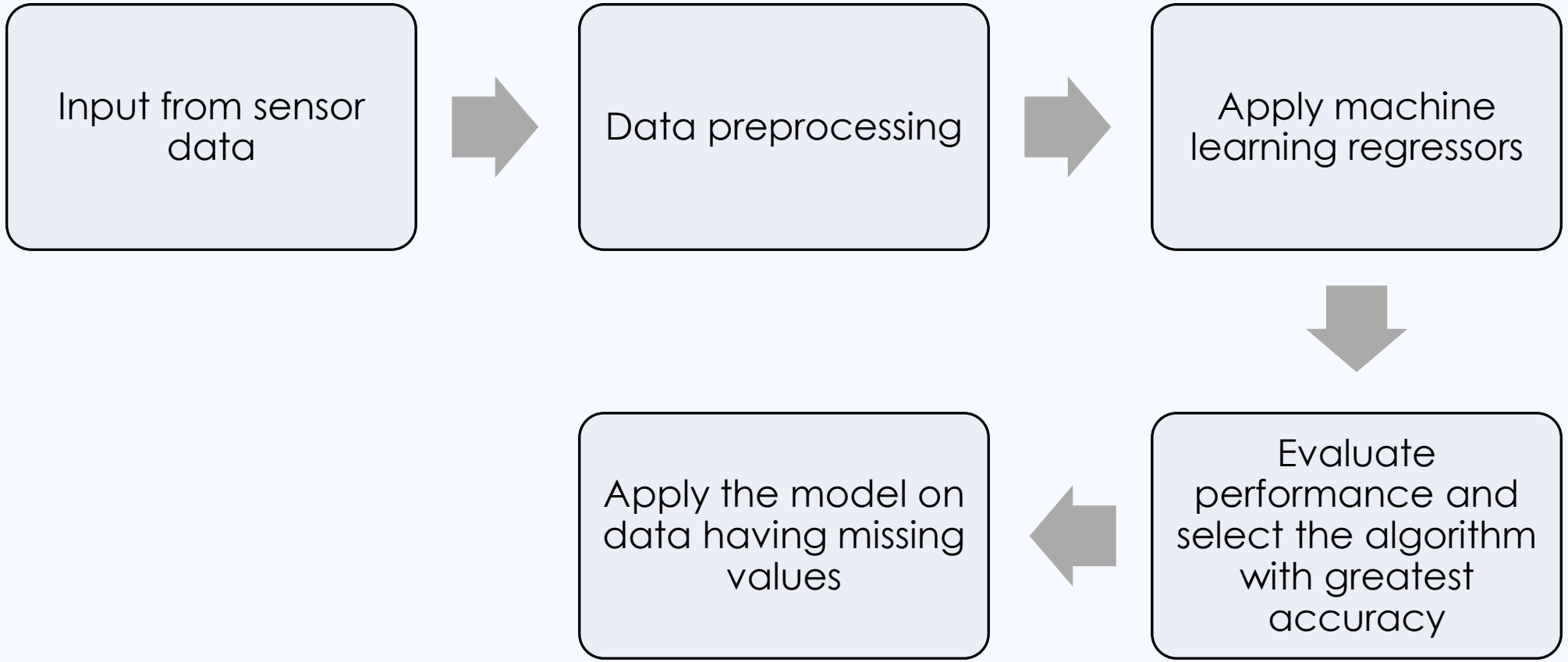
OVERALL ARCHITECTURE

Reconstruction of Missing Data

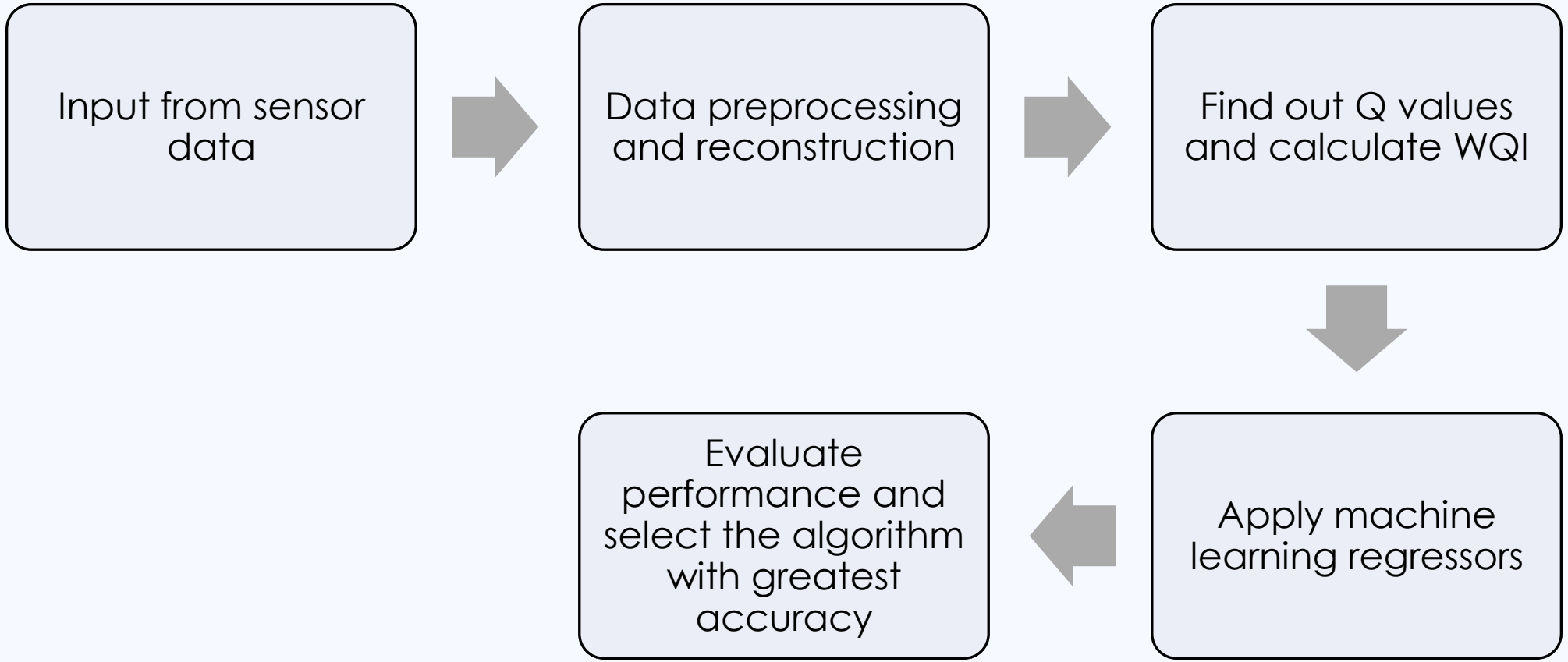
Prediction of WQI

Classification based on WQI

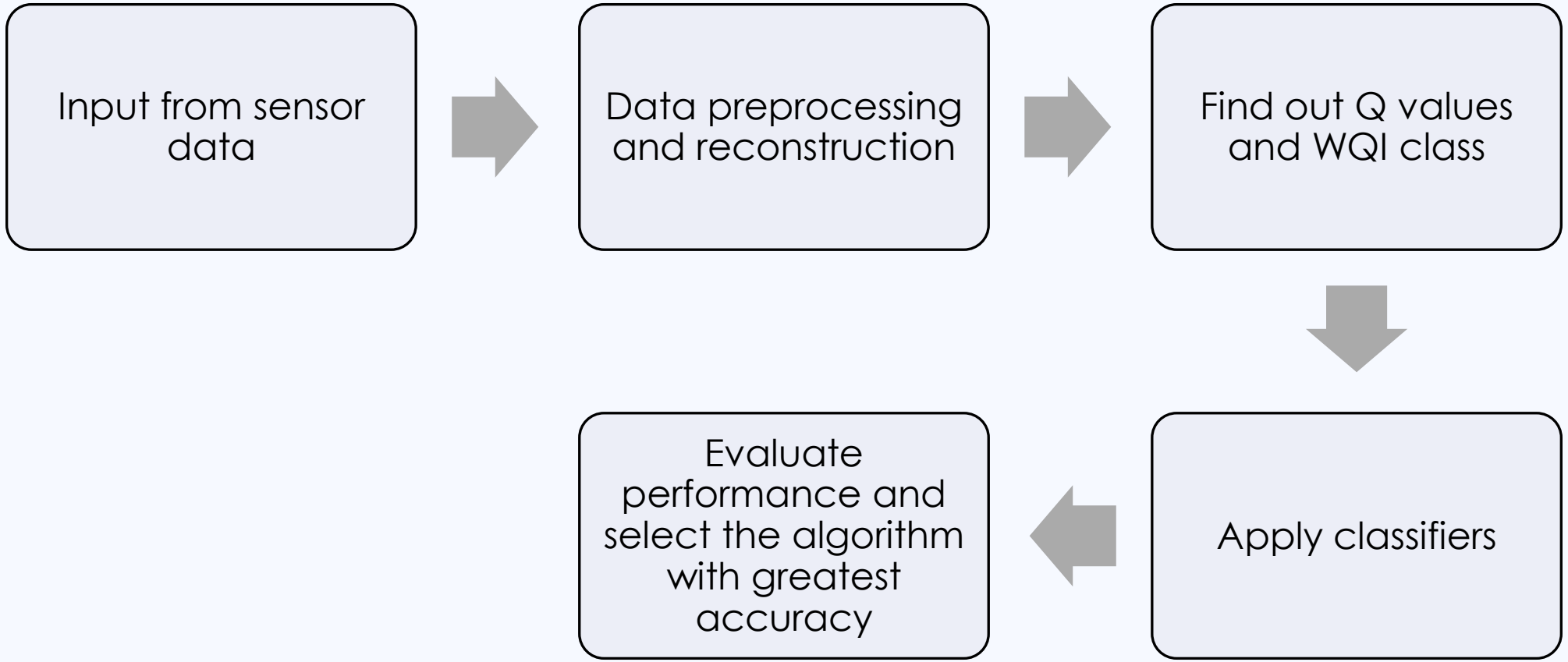
RECONSTRUCTION OF MISSING DATA



PREDICTION OF WQI



CLASSIFICATION BASED ON WQI



EXPERIMENTAL SETUP

Operating System	Unix based Windows NT based
Programming Languages	Python3
Python Libraries	Pandas NumPy Scikit-learn Matplotlib Seaborn

Results for prediction of missing values

Best result is obtained for ExtraTrees regressor

Method	MSE	R^2 Score
Linear Regression	11.31585	0.852188
Random Forest Regression	0.94134	0.9877
ExtraTrees Regressor	**0.727**	**0.9905**
Gradient Boosting Regressor	3.12163	0.95922
Polynomial Regression	3.26492	0.95735
MLP Regression	11.4655	0.85023

Results for prediction of WQI

Best result is obtained for Gradient Boosting Regressor

Method	MSE	R^2 Score
Linear Regression	42.56974	0.56938
Random Forest Regression	7.00893	0.9291
ExtraTrees Regressor	14.39321	0.8544
Gradient Boosting Regressor	**8.05242**	**0.93297**
Polynomial Regression	29.84263	0.69812
MLP Regression	36.46944	0.69642

Results for classification based on WQI

Best result is obtained for Random Forest Classifier

Method	Accuracy	Precision
ANN	0.63291	0.33629
SVM	0.83228	0.63661
GRADIENT BOOST CLASSIFIER	0.92089	0.73205
RANDOM FOREST CLASSIFIER	**0.92405**	**0.73373**
DECISION TREE	0.89241	0.69453

FUTURE WORKS

Develop a mobile/web application

Using Soil and Weather Data to predict crop yield

Work on other phases of agriculture such as soil preparation, crop selection, fertilizing and harvesting