

Dryer Machine Optimization Using Reinforcement Learning

Minh Ha, Technical Director

TMA Innovation Center



Project Goals



Automate Machine Control

- Fully automate and remote control machine
- Real time data collection & sent to cloud

Predict Moisture Content

- Predict relative amount of water remained during drying cycle

Optimize Drying Time

- Self optimizing drying process using reinforcement learning model

Challenges

Unclear of sample data and technical feasibility when started

Not many working use case for Reinforcement Learning in real world

Handle lots of machine issues with only remote support

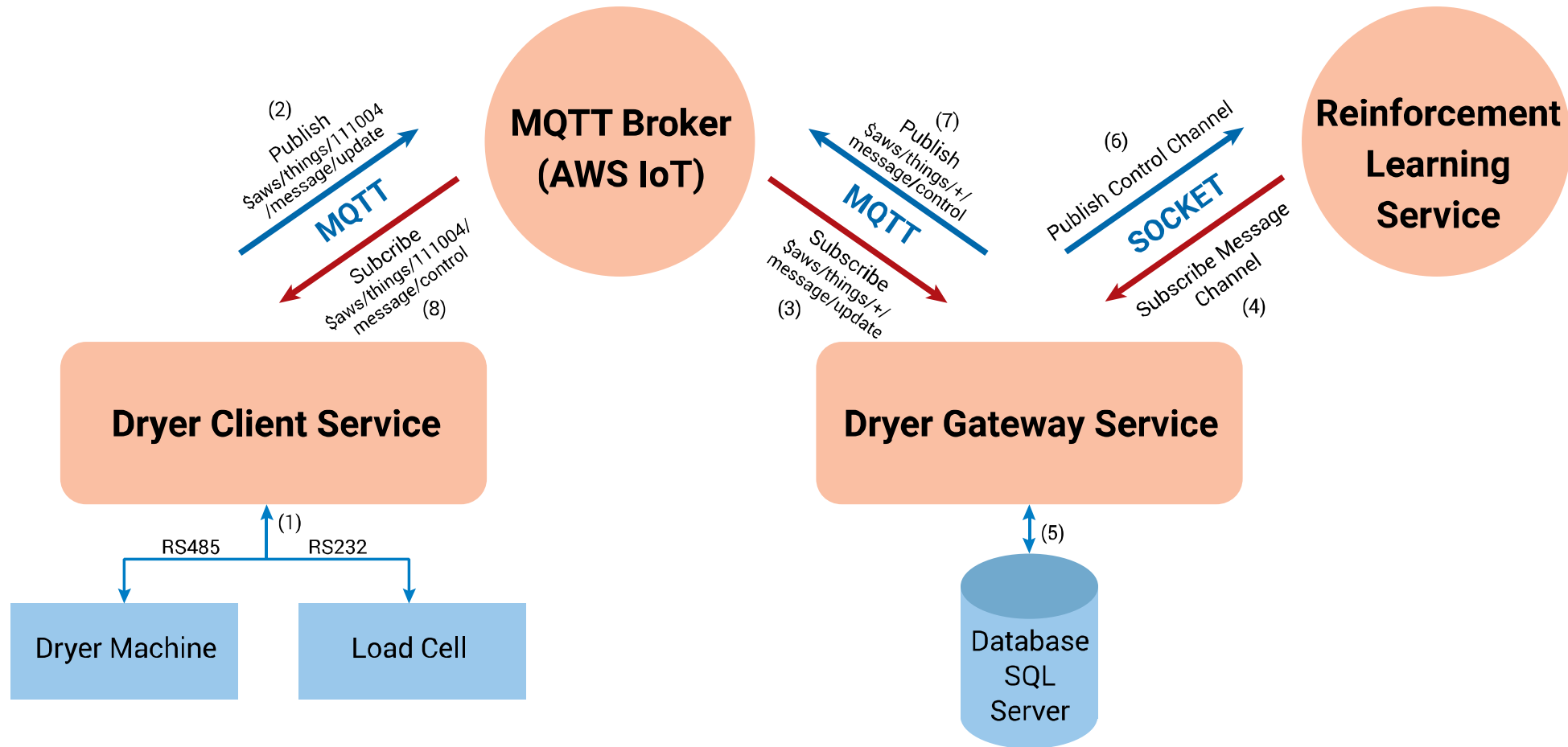
Machine Control

Replace default controller board by a Single Board Computer (Raspberry Pi 3)

Fully control heating (4 modes), drum rotation and speed (8 speeds), fan (8 speeds), water

Data collected (weight, temperature, exhausted humidity) during runtime via MQTT protocol to AWS IoT backend

Data Collection Diagram



1. The client reads all data (machine, sensor, loadcell).
2. The client sends data to AWS IoT via a public topic.
3. The gateway receives data via a subscribed topic.
4. The gateway forwards received data on a message channel.

5. The gateway stores received data into MS SQL Server DB.
6. The RL service process data and send controller data to the gateway.
7. The gateway forwards the controller data to clients.
8. The client receives controller data and controls the machine.

Drying Time Optimization

**Default Mode:
40 minutes**

Reduced to

**Reinforcement
Learning Model**

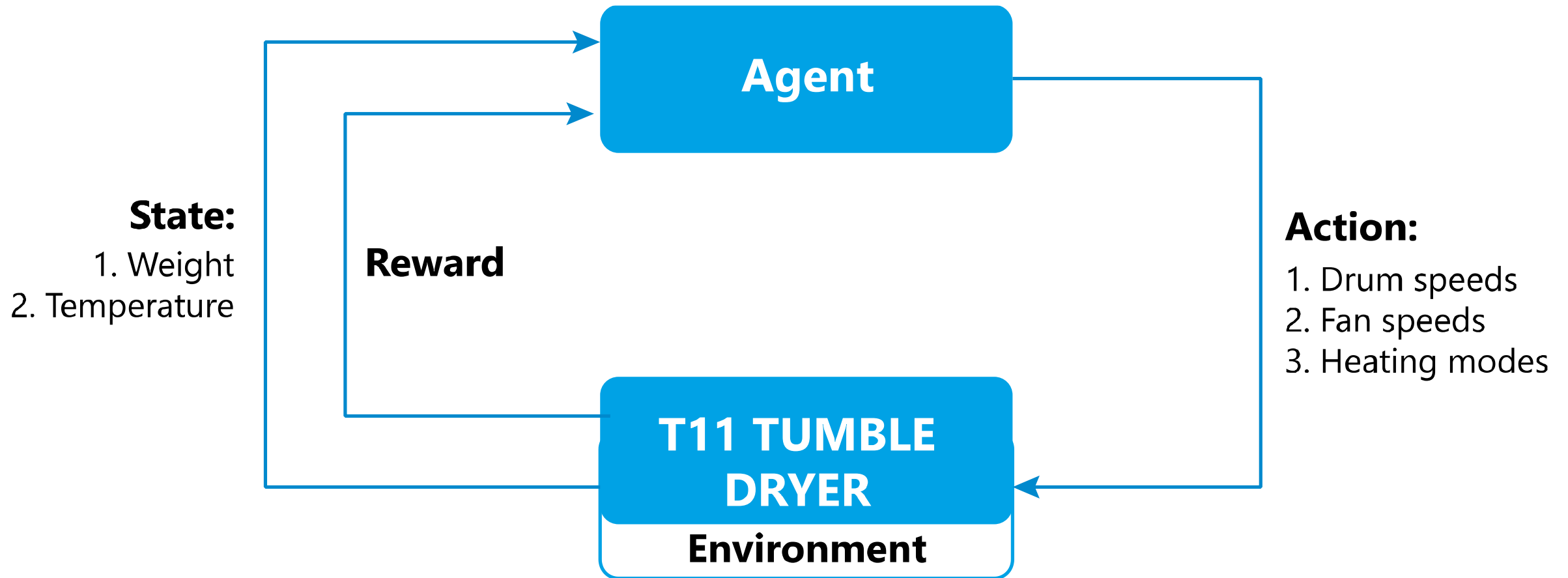
28-32 minutes

Fuzzy Control Model

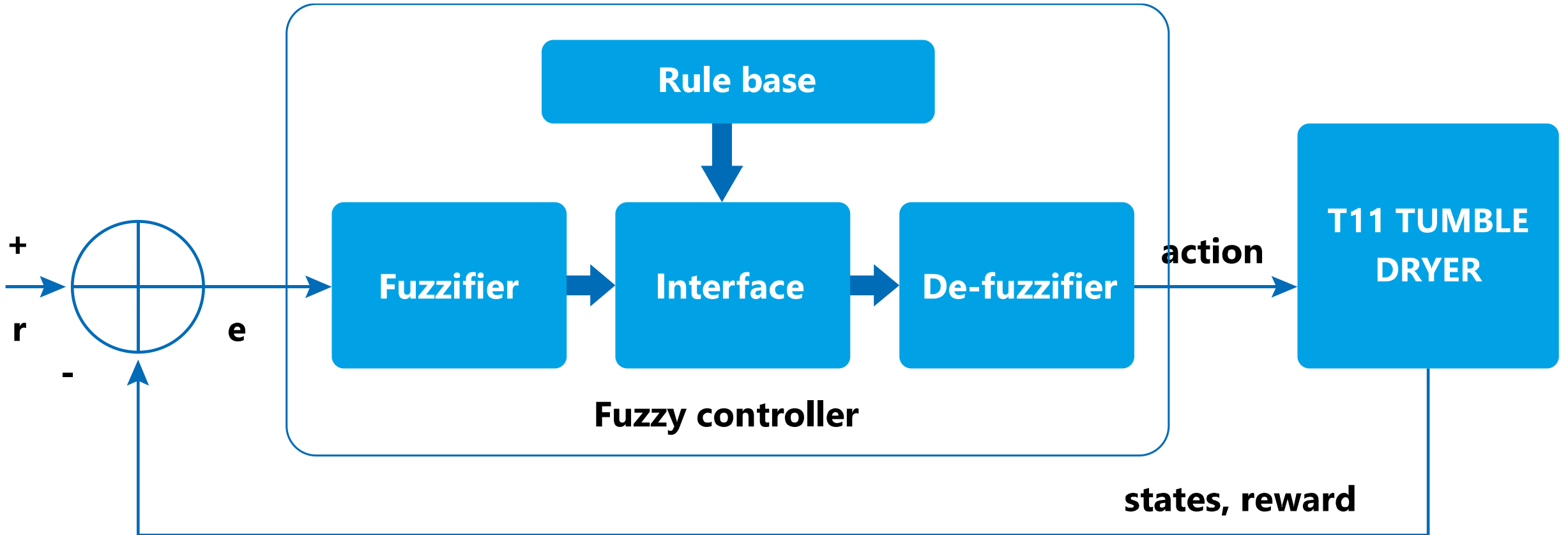
24-28 minutes

**Improvement achieved after
~160 experiment cycles**

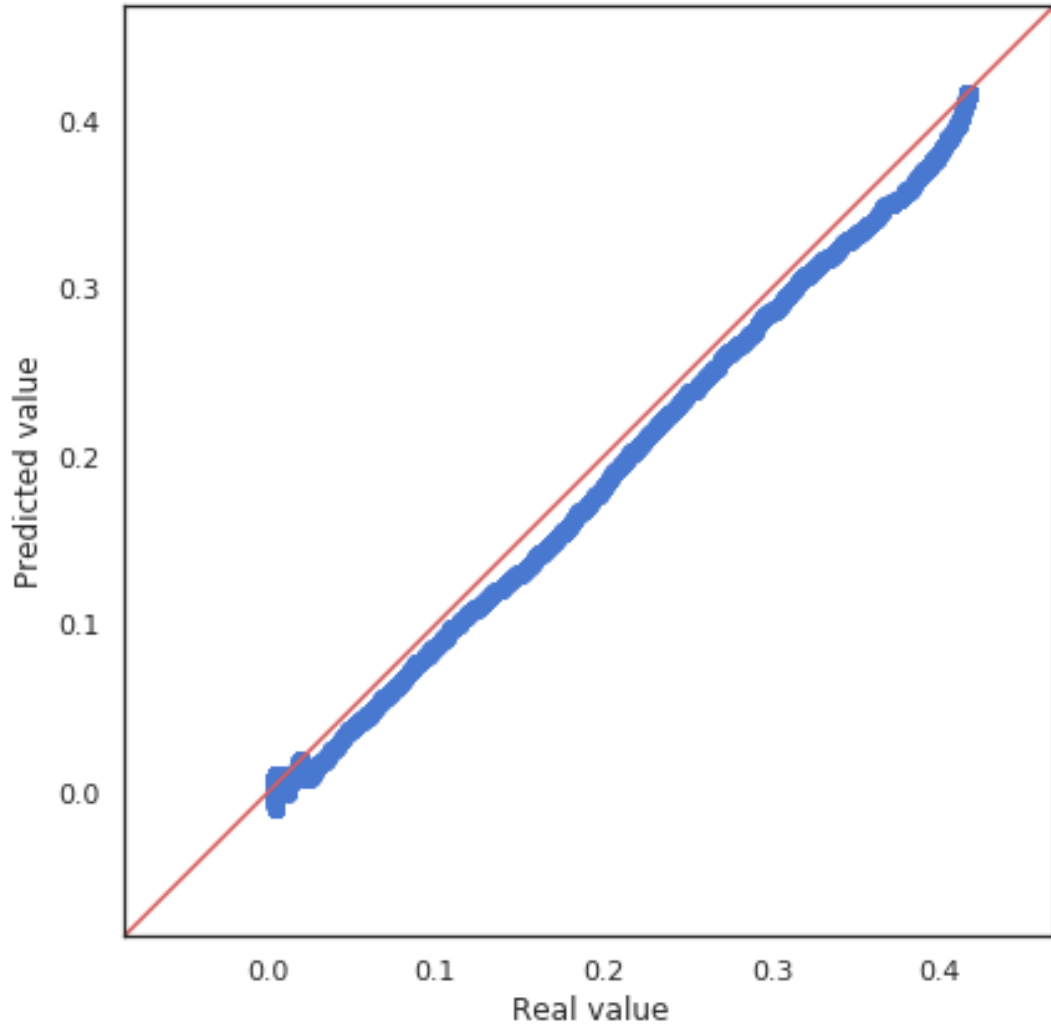
Reinforcement Learning



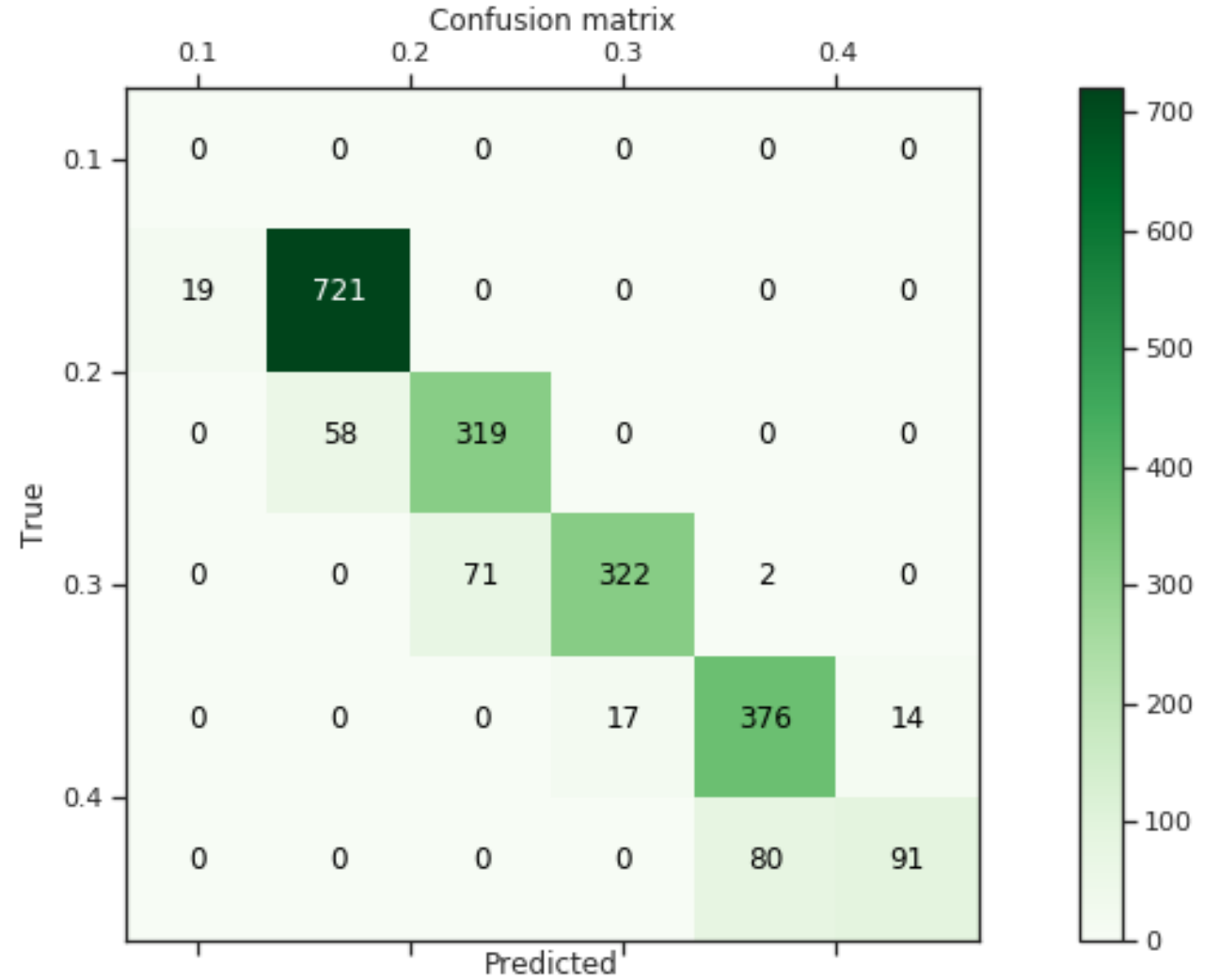
Fuzzy Logic Control



Residual Moisture Prediction



RME: 0.0002



F1-score: 0.88