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Keeping your Cool: Predicting Temperature during Delivery

Motivation / Background

- The **pharmaceutical industry** is a considerable part of the global economy and has experienced significant growth.
- Temperature controlled supply chains** are vital to the pharmaceutical industry.
- Due to the number of packages shipped yearly, **efficient passive packaging design** will lead to cost savings.
- Reducing **prequalification time** of shipping solutions.
- Save laboratory testing costs for **new configurations** of passive temperature control containers



Key Question / Hypothesis

How can the **internal temperature changes** in passive packaging **be predicted** as the goods move through the supply chain of a pharmaceutical company?

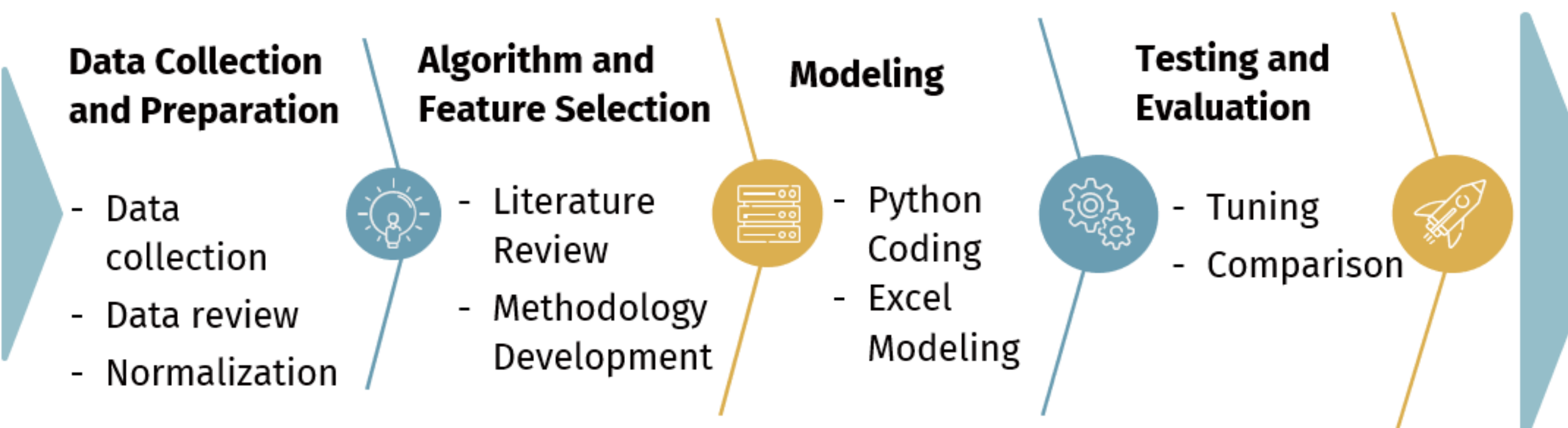
Relevant Literature

Mentink, T. (2018, November). Optimization of packaging options in the cold supply chain. Eindhoven University of Technology.
 Spyros Makridakis, E. S. (2018). Statistical and Machine Learning forecasting methods: Concerns and ways forward. PLoS ONE, 13(3).

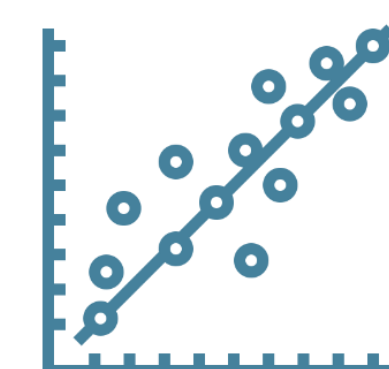


Problem and Methodology

-The **behaviour of passive temperature** control solutions depend on their **setup** and the **ambient temperatures** the package goes through during transit.



Methods:



Traditional

- Autoregression
- ARIMA

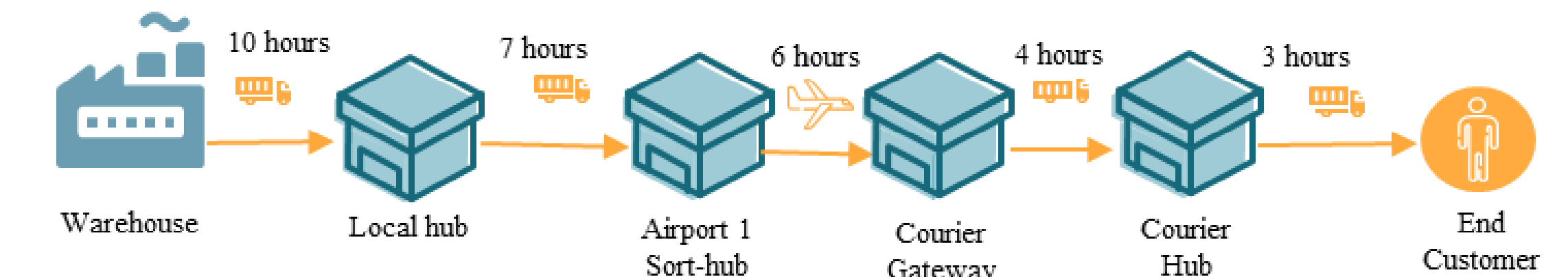


Machine Learning

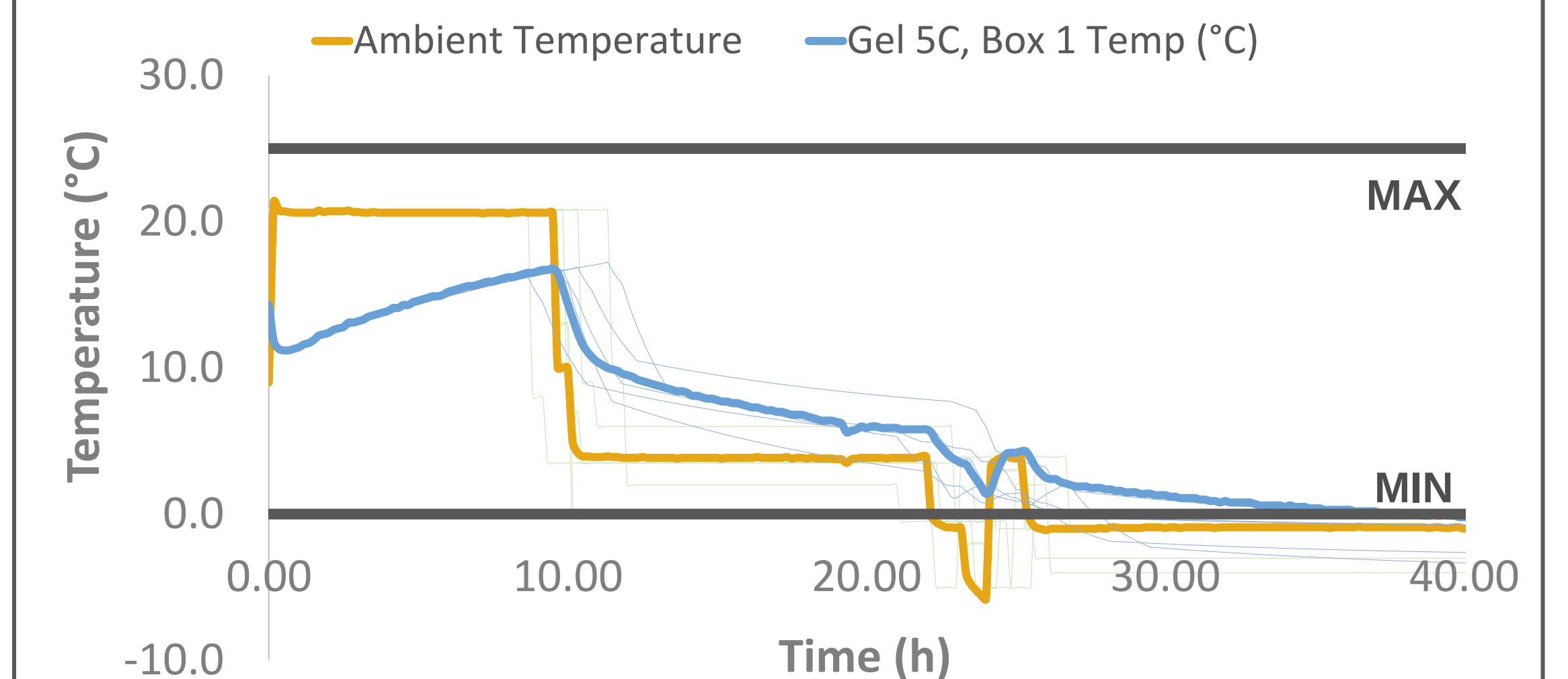
- K-Nearest Neighbors
- Random Forest
- Support Vector Machines
- Quantile Regression
- Neural Networks

Results

- Successful predictive model for **internal temperatures** based on the **variability of external temperatures** and delivery **lead-times**



Internal Temperature Prediction on Simulated Profiles



Contribution

- Estimate the product performance** against various ambient temperatures across the supply chain.
- Predict the success of the passive package container** due to changes in its components.



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