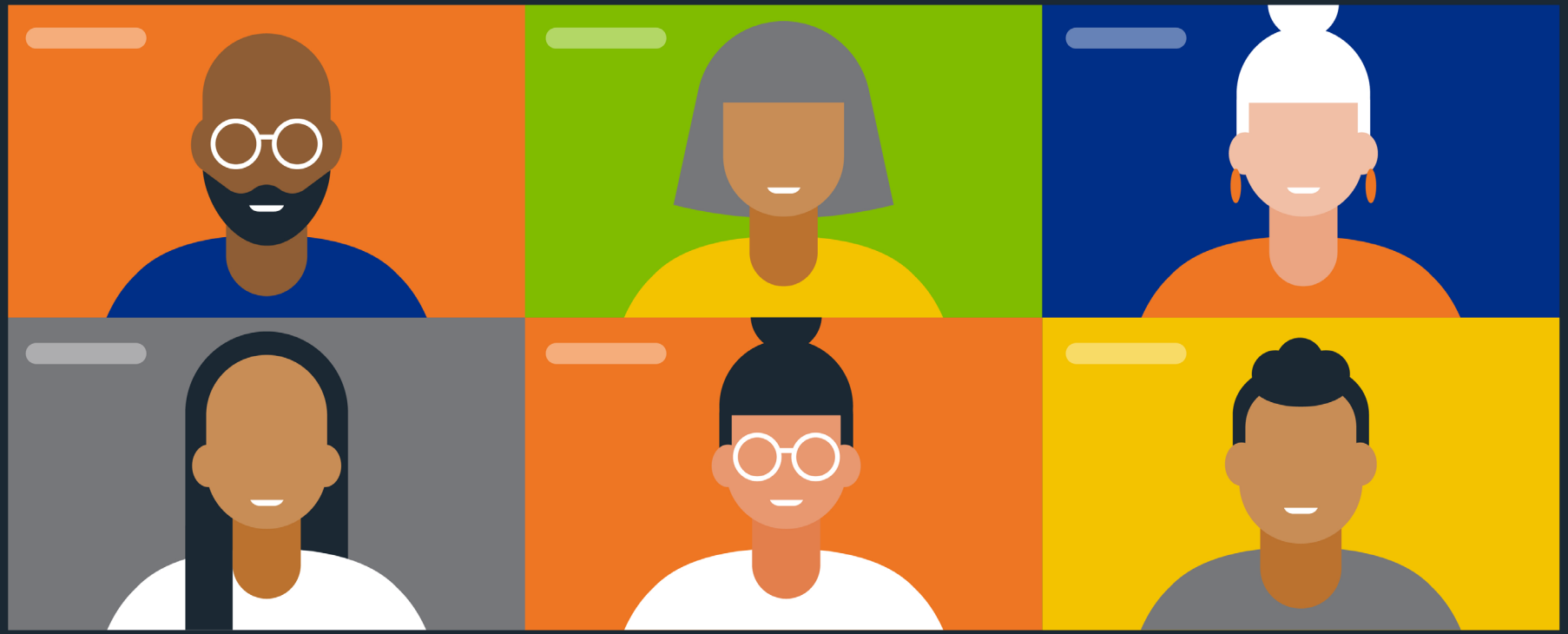


informs ANNUAL MEETING | 2020 VIRTUAL

ML in Departure Prediction of Freight Trains

Niloofar Minbashi

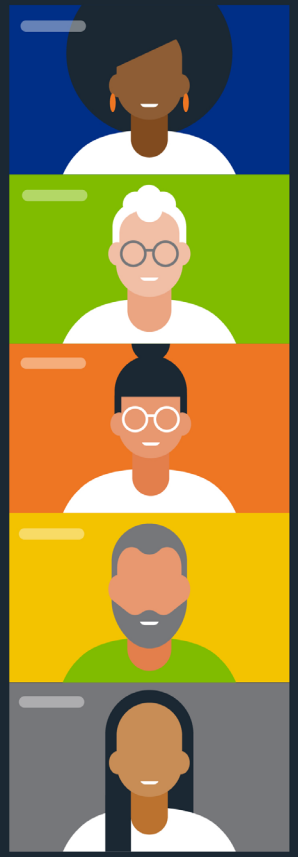
Agenda

Motivation

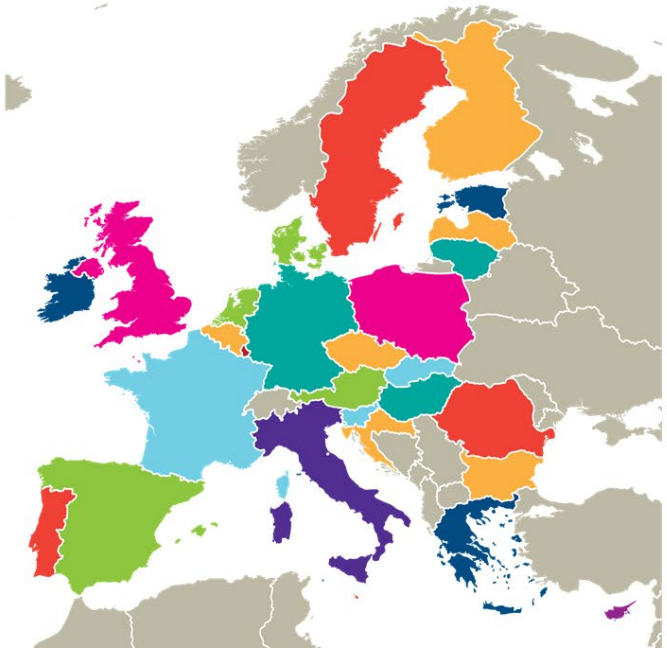
Method

Result

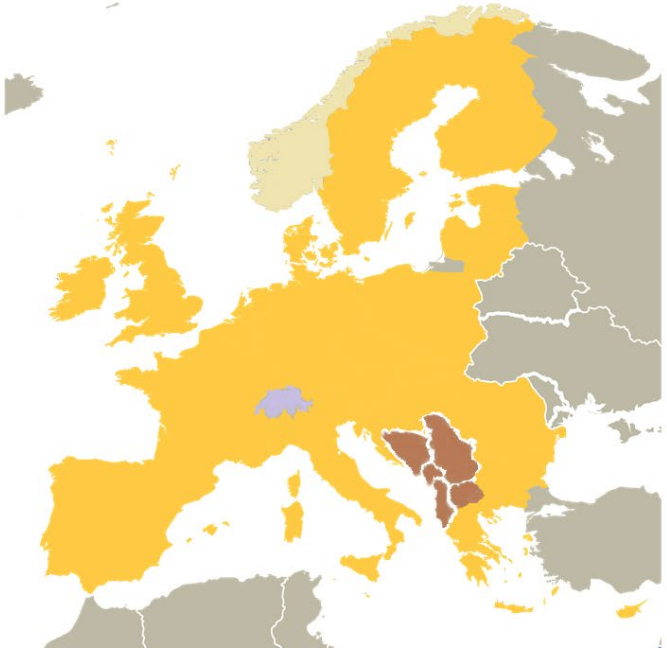
Future Direction



From this ….

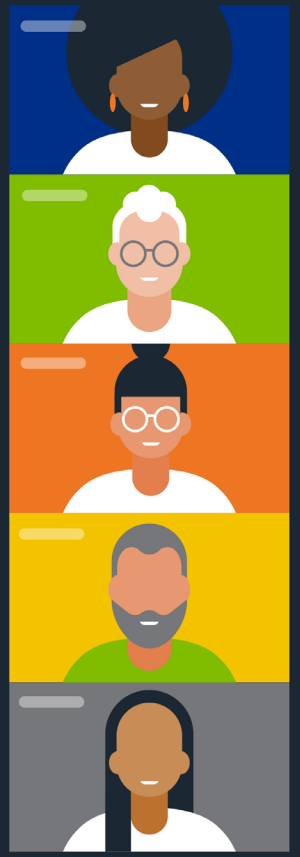


to this …



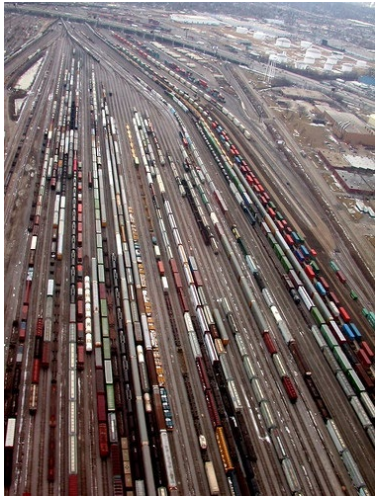
Single European Rail Area

Source: unece.org



informs

Rail Yards



Yard - Network

2015 / 2016

ARC

Smart

2017

fr8hub

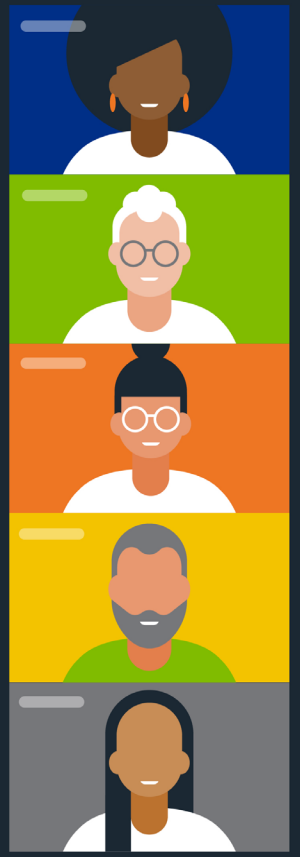
OPTIYARD Optimised Real-time Yard and Network Management

2018

FR8RAIL II

2019

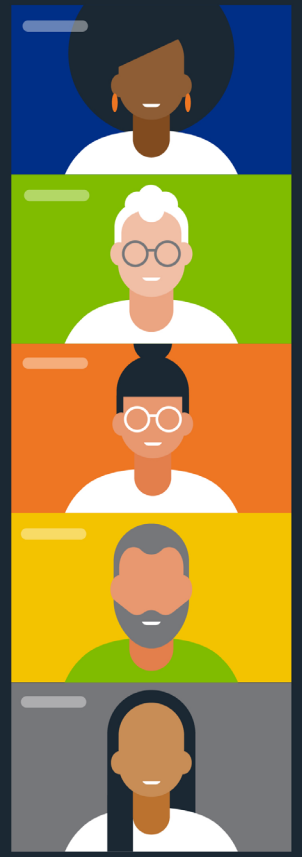
FR8RAIL III

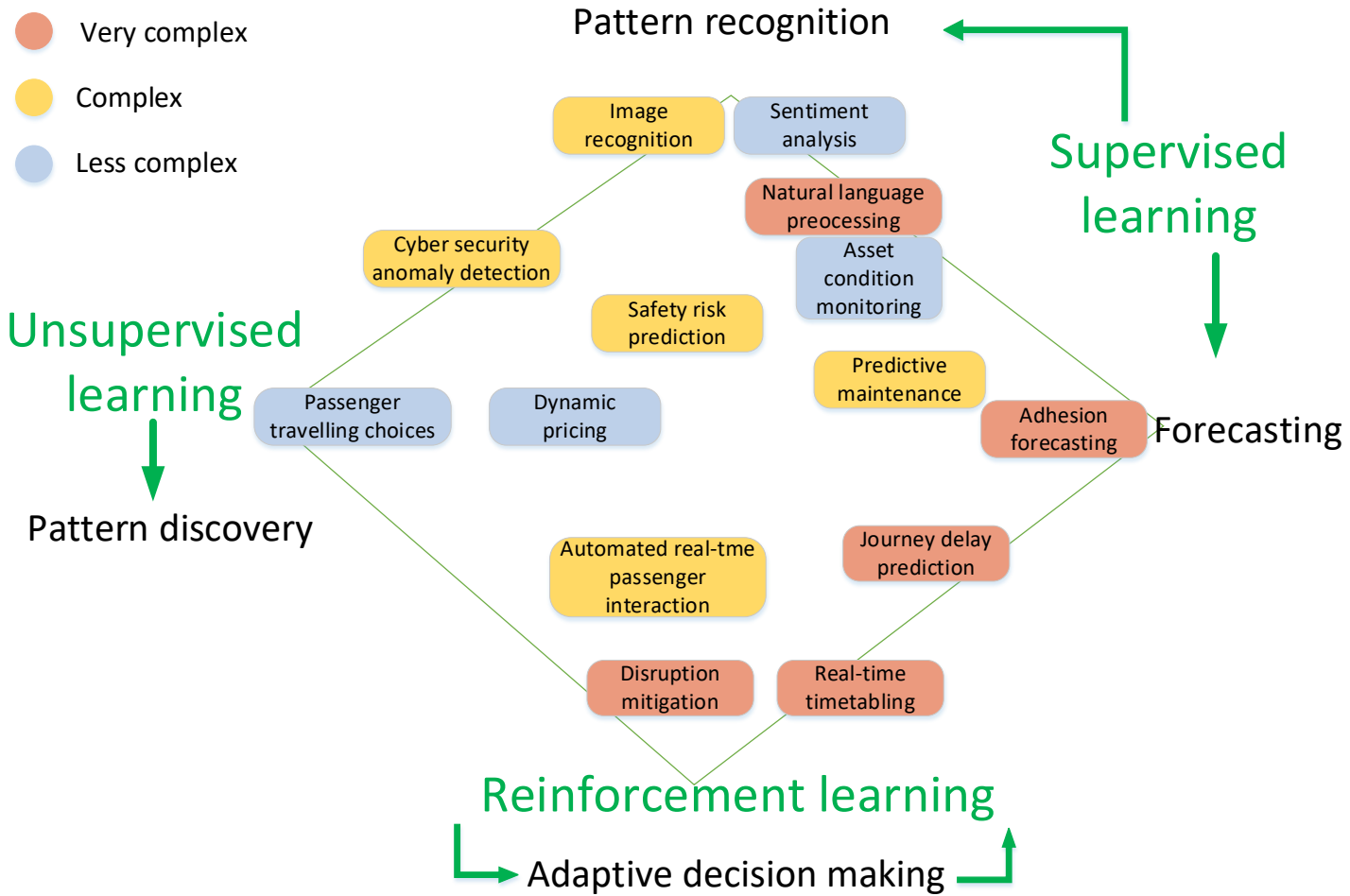


informs

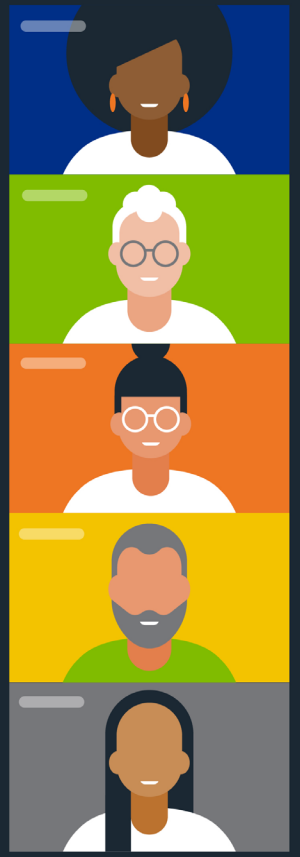

Esplanaden
Esplanaden
Esplanaden
Tälleleden
Västra Storgatan
Västra Storgatan
Västra Storgatan


Network
Arrival yard
Hump
Classification yard
Departure yard
Network

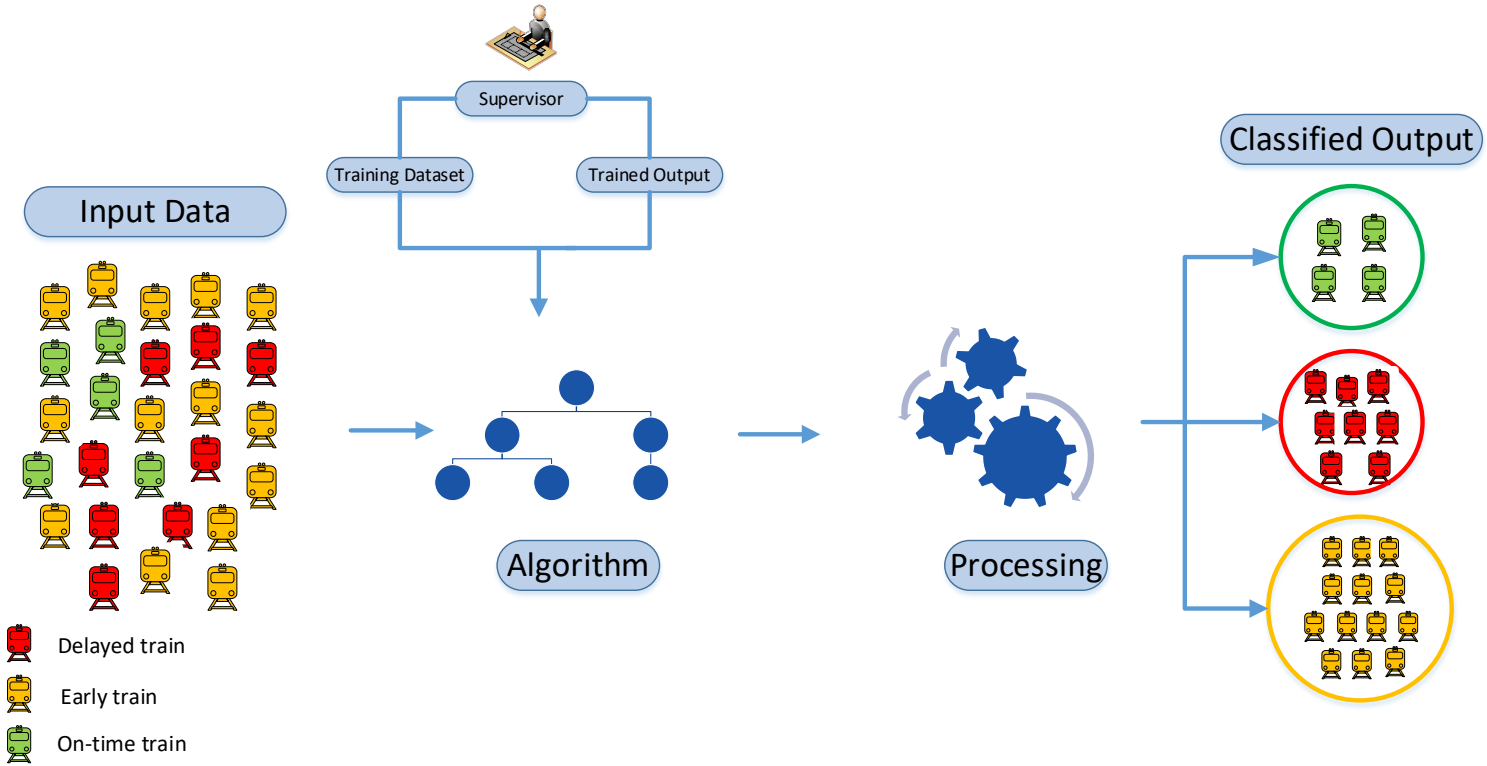




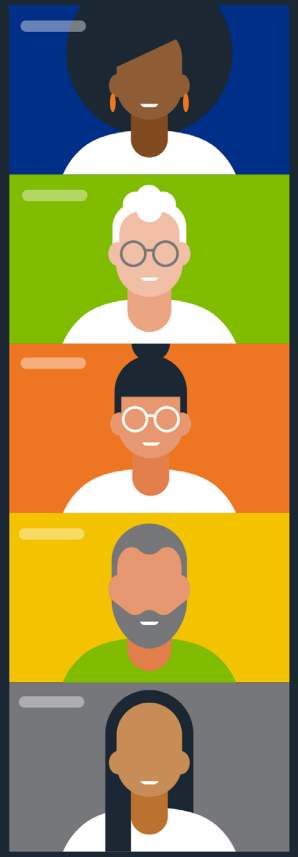
Source: RSSB

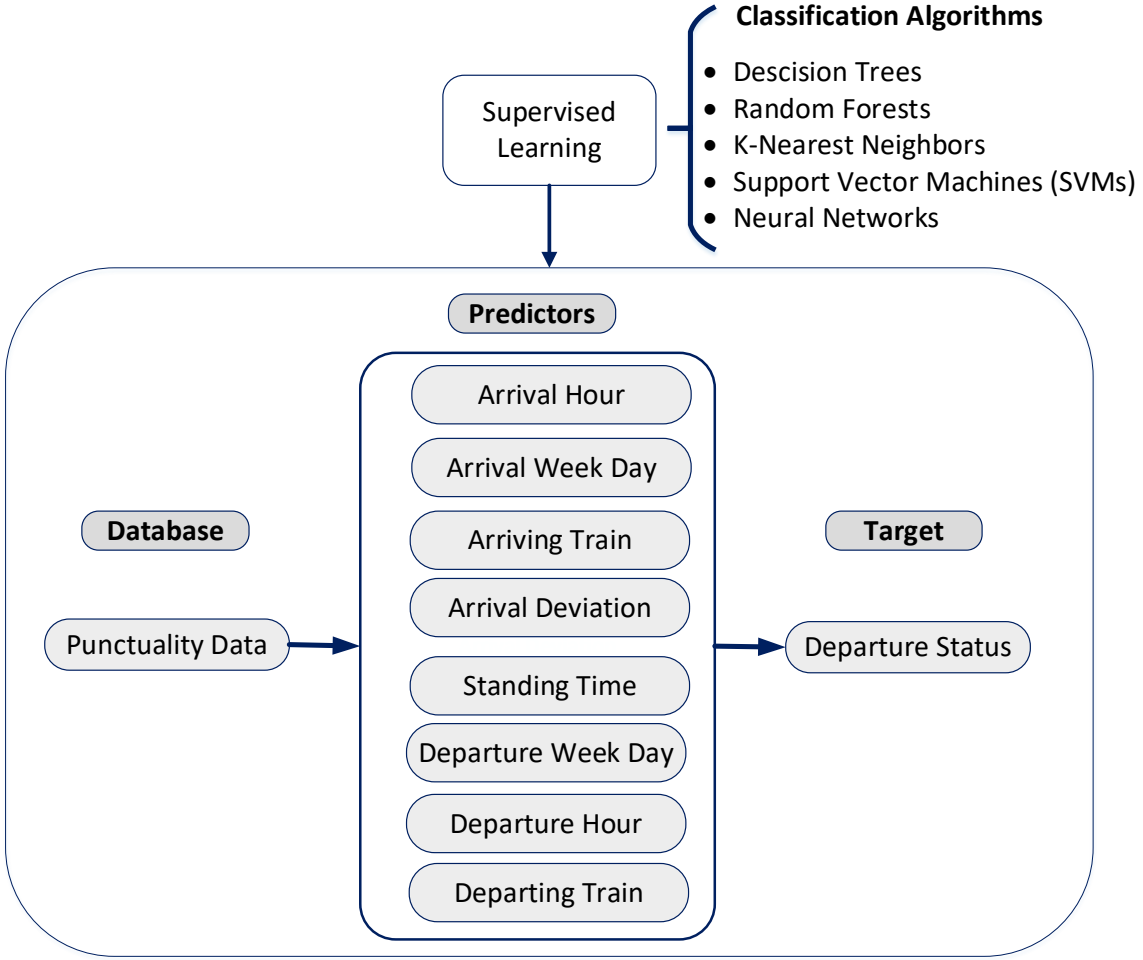


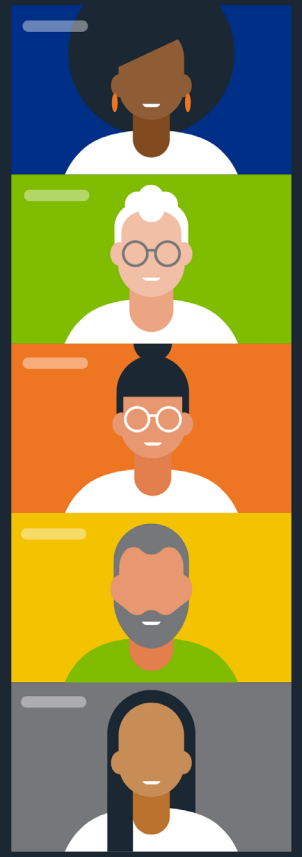
informs



Supervised Learning (Classification)




Classification Algorithms
Descision Trees
Random Forests
K-Nearest Neighbors
Support Vector Machines (SVMs)
Neural Networks
Supervised Learning
Predictors
Arrival Hour
Arrival Week Day
Arriving Train
Arrival Deviation
Standing Time
Departure Week Day
Departure Hour
Departing Train
Database
Punctuality Data
Target
Departure Status

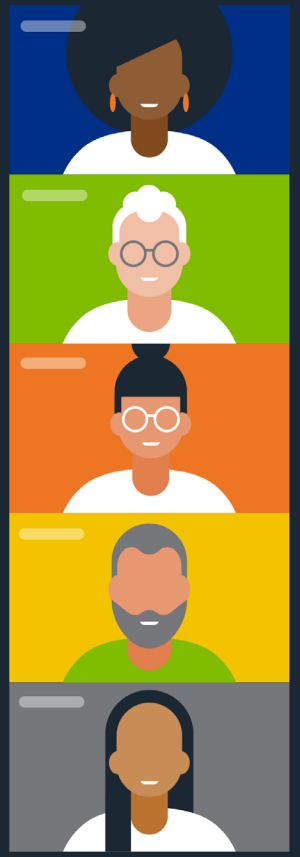


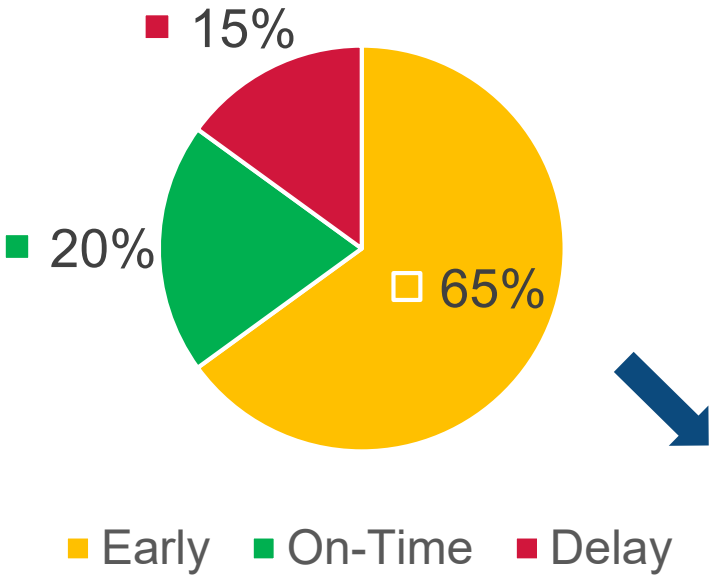
informs

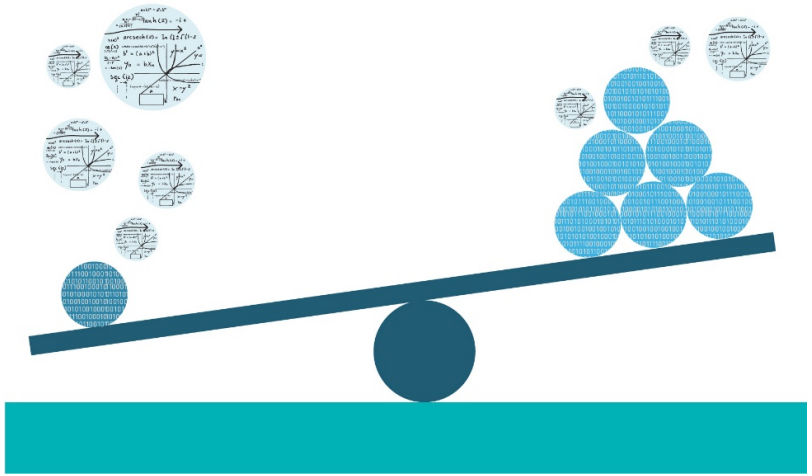
Random Forest

- Hallsberg (largest yard in Scandinavia)
- One month data
- 6243 departures

Class	Recall	Precision
Delayed	24%	63%
Early	93%	78%
On-time	43%	68%

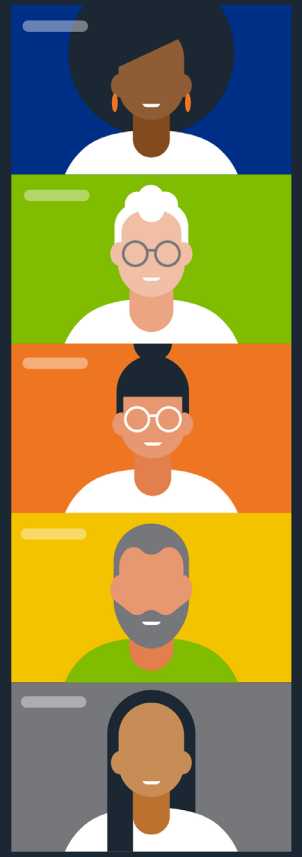






Imbalanced Data

Source: datascience.aero

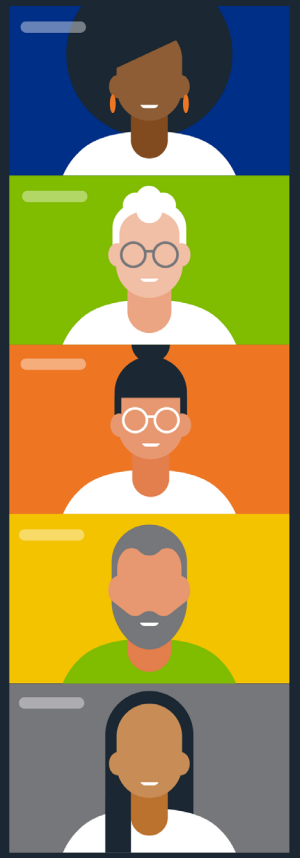


informs

Random Forest

SMOTE:
Synthetic Minority Over-sampling Technique

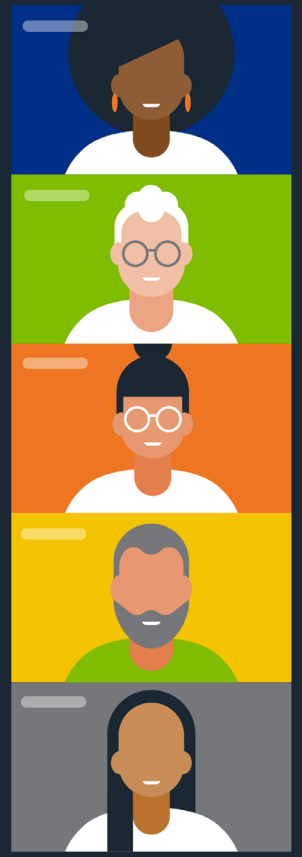
Class	Recall	Precision
Delayed	~~24%~~ 62%	~~63%~~ 68%
Early	~~93%~~ 84%	~~78%~~ 71%
On-time	~~43%~~ 62%	~~68%~~ 68%



informs

Future Direction

- Promising application of ML for yard departure prediction
- Main challenges: different data owners, data security
- Adding more predictors
- Comparison with other shunting yards



Thanks for your attention!

Niloofar Minbashi
PhD Student

Division of Transport Planning
KTH Royal Institute of Technology
Stockholm, Sweden
minbashi@kth.se