Predicting Flight Delays

OnTime Technologies

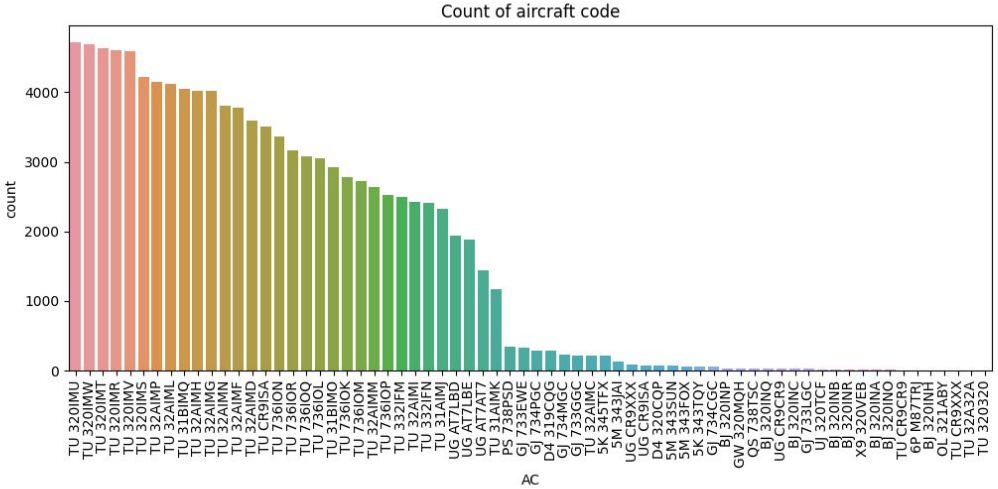
Introduction: Predict flight delays for Tunisair

What we did:

- **Developed** three predictive models for flight delays ✔
- **Identified** the most accurate model ✔
- **Goal**: Provide more accurate predictions → Fewer surprises, better customer experience, and optimized operations ✔

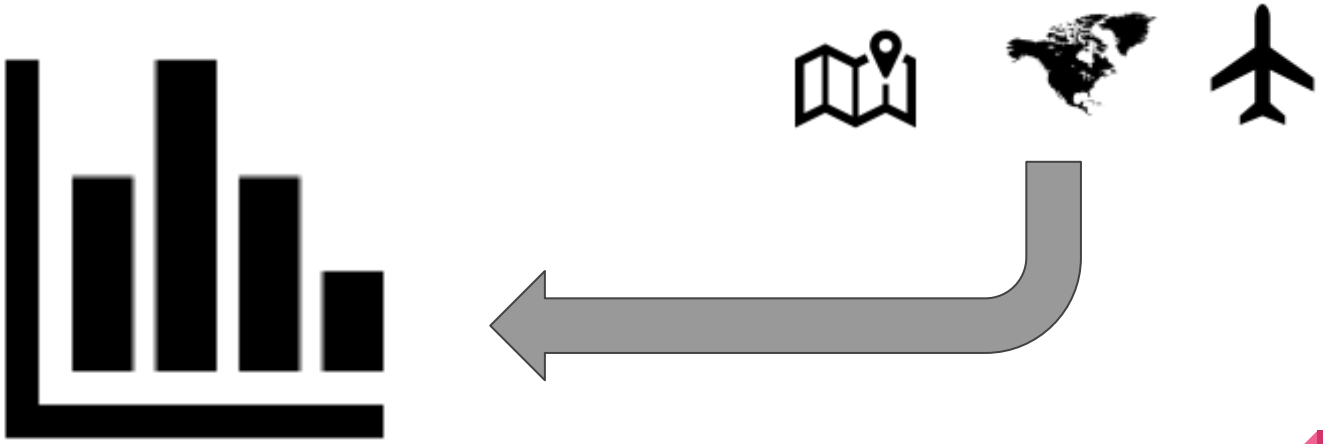
Dataset: Description and challenges

- **Flight Delay** from Tunisair
- Size: 107883 entries x 10 columns (+ 1 column for the delay)
- Timespan: 2016-01-01 to 2018-12-31
- Challenges: Class imbalance in categorial features, missing (relevant) predictors?



External information

Data containing information about country, continent and type of airports



Predictors for Flight Delay

Aircraft Code

Airport Type (e.g. Large or Small)

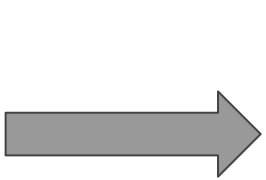
Departure and Arrival

Day

Time

Weekday

Month

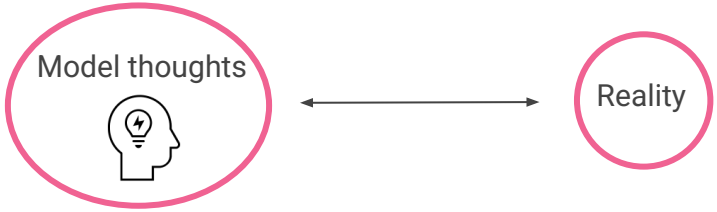


Country of Departure and Arrival

Domestic flight

How accurate are our models in predicting flight delays?

RMSE: How far apart on average is the model prediction away from actual values?

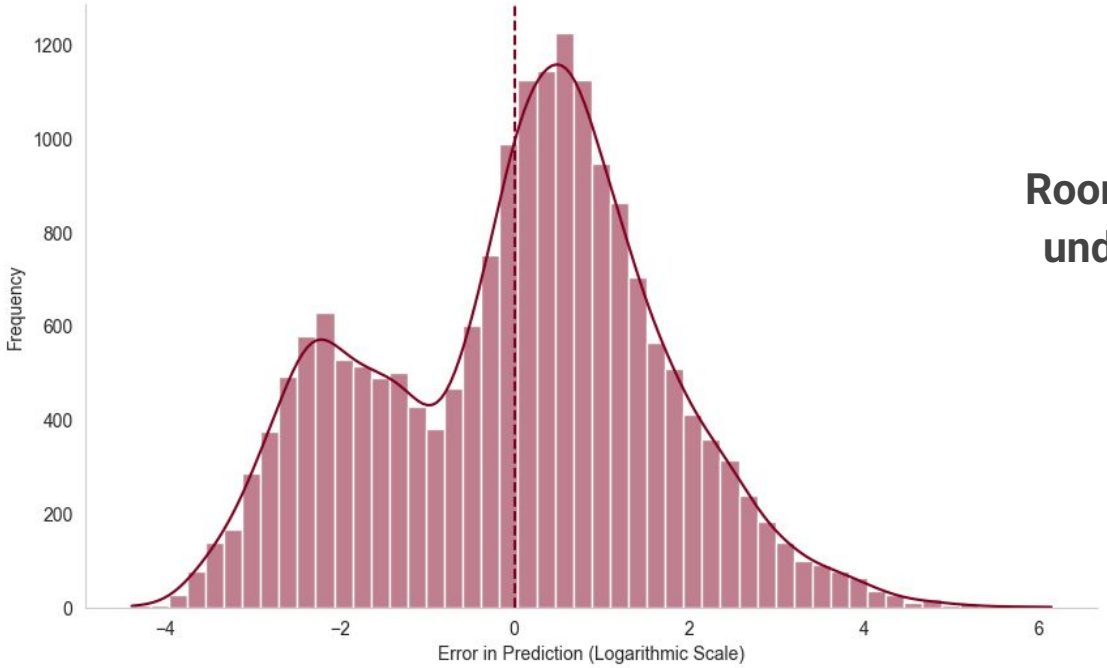


Advanced models

Linear model	LightGMB	CatBoost	XGBoost
121 min	119.5 min	117.1 min	118.5 min

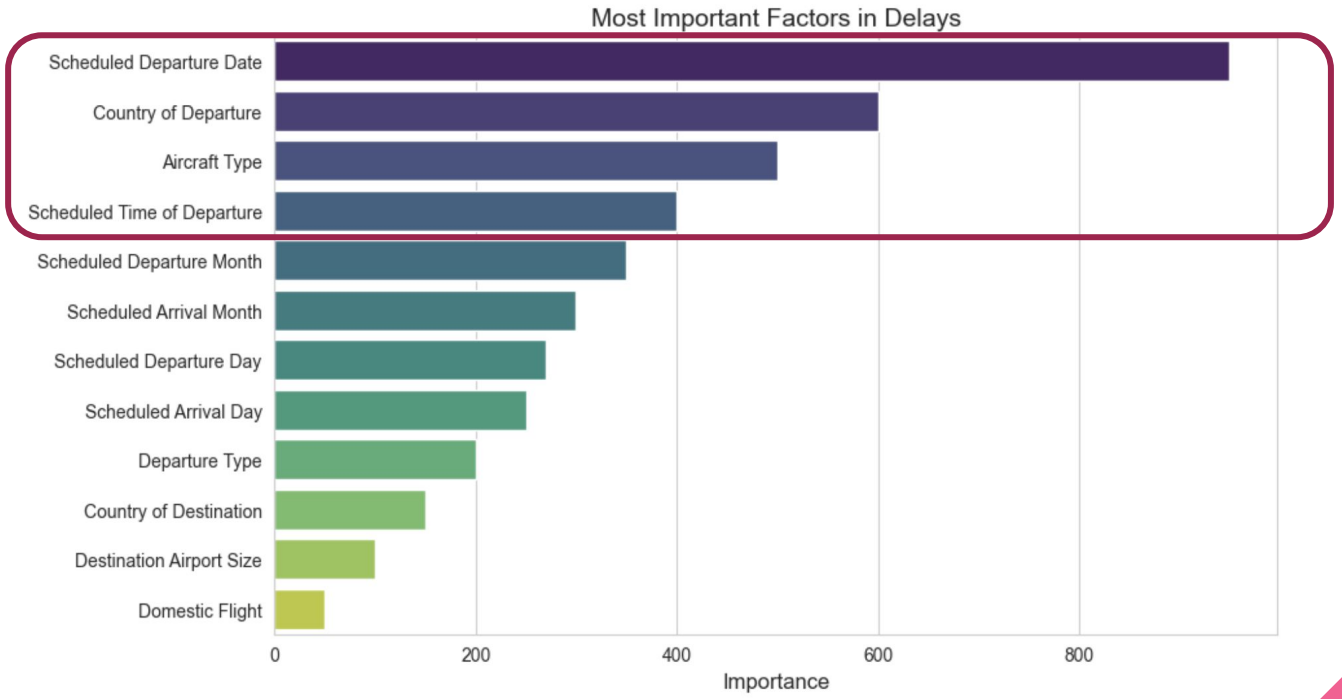
Advanced models outperform the simpler model

How accurate are our models in predicting flight delays?



Room for improvement: Reduction of underprediction and overprediction

Factors Contributing to Delays



The top four factors that impact delays, based on our model.

What’s Missing? Key Factors Not in Our Data

Weather Conditions 🌧️

Severe weather and visibility

Air Traffic Congestion ✈️

High airport traffic during peak hours

Highest impact and frequent

Airport Infrastructure & Runway Capacity 🏗️

Number of runways and maintenance

Connecting Flights & Ripple Effects 🔄

Delayed initial flight

High impact

Pilot & Crew Availability 👨‍✈️

Strike actions or crew shortages

Passenger-Related Delays 🧳

Security checks

We can improve our predictions and create meaningful business results!

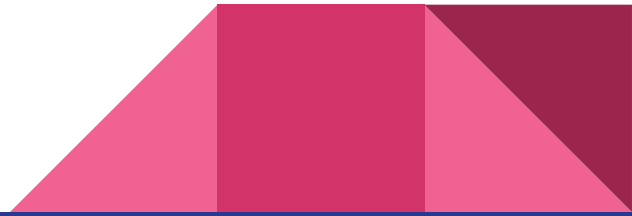
Business Impact of Predictions

Airlines

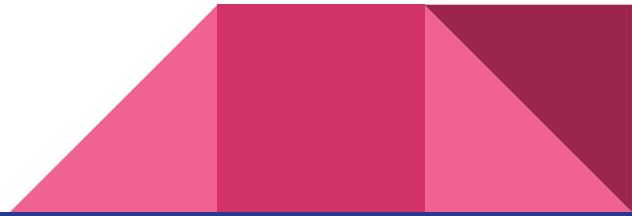
- Real-time notifications improve experience
- Reduced operational costs (fuel, crew overtime, maintenance)
- Optimized gate and crew scheduling
- Minimized compensation costs for delays

Airports

- Efficient runway and gate allocation
- Reduced congestion and improved scheduling



Focus on Passengers

Revenue & Optimization Potential

- Airlines can **upsell** premium services like priority boarding and travel insurance based on delay predictions
- **Competitive advantage** for airlines that use AI-driven delay insights to improve their operations
- Real-time **push notifications** to improve experience like
  lounge access
  coffee vouchers
  time to gate feature