From Prototype to Operative Software with RapidMiner
Data Analytics @ Lufthansa
Our Locations

Wolfsburg
Norderstedt
Berlin
Wetzlar
Hamburg
Basel
Cologne
Oldenburg
Miami
Frankfurt
Our Locations

Hard Facts

Managing Director
Bernd Appel

Founding
1998 as Industry Solutions division within Lufthansa Systems AG

100% owned by Lufthansa

217 Mil. €
total revenue (50 % of which within the Lufthansa Group)

1,500
skilled employees
(Update: Q2 2018)

>200
customers
## Technology Services of Lufthansa Industry Solutions

<table>
<thead>
<tr>
<th>Service</th>
<th>Icon</th>
<th>Technology Stack</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Data Analytics/Data Engineering</strong></td>
<td><img src="image1.png" alt="Icon" /></td>
<td>Artificial Intelligence</td>
</tr>
<tr>
<td><strong>Industrial IoT</strong></td>
<td><img src="image2.png" alt="Icon" /></td>
<td>Security</td>
</tr>
<tr>
<td><strong>OLTP- &amp; Mobile Development</strong></td>
<td><img src="image3.png" alt="Icon" /></td>
<td>SAP</td>
</tr>
<tr>
<td><strong>Cloud Computing</strong></td>
<td><img src="image4.png" alt="Icon" /></td>
<td>Blockchain</td>
</tr>
</tbody>
</table>

+ Digital Lab (Hamburg & Frankfurt)
Process Model

We deliver actionable insights from your data
FlightPrediction @ Lufthansa
We predict the arrival time as the aircraft takes off
Accurate OnBlock arriving estimates are crucial for effective airline operations
Business and Analytics Process Alignment

Prediction Time

Prediction Point

Gate - to - Gate

Rolling

Airtime

Rolling

Departure

Takeoff

Landing

Arrival

Avg. error of arrival estimates

* Analysis is based on a randomly drawn test data sample
How? Unleashing The Power of Big Data

Historized Flight Data Stream

Eurocontrol

Weather Data Stream

Data Warehouse

z_k = \beta_0 + \sum_{j=1}^{J} \beta_j x_{j,k} + u_k

Reporting Server

Predicted Arrival Time

Sources: aviationweather.gov/radar/mosaic
flightradar24.com
lufthansa.com/us/en/Route-Map
The Cycle
Model Building

- A few rolling window features are good!
- Prefer models that can be trained fast:
  Play around with features instead of models.

\[
\begin{align*}
 f_{X_s| \{X_{t_1}, \ldots, X_{t_n}\}}(y|y_1, \ldots, y_n) &= \mathcal{N}(\mu_{s|t}, \sigma_{s|t}) \\
 \mu_{s|t} &= (k(s, t_1), \ldots, k(s, t_n)) K_t^{-1} y_t \\
 \sigma_{s|t} &= k(s, s) - (k(s, t_1), \ldots, k(s, t_n)) K_t^{-1}(k(s, t_1), \ldots, k(s, t_n))^T
\end{align*}
\]
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The Cycle

16.10.18
From Prototype to Operative - Data Analytics @ Lufthansa
Automation: Supervisor

Supervision of Model

- Runs every hour
- Asserts that ...
  - enough data
  - enough predictions
  - predictions produced fast
  - not too much missing data
  - ...

15 16.10.18 From Prototype to Operative - Data Analytics @ Lufthansa
Lessons Learned
Go To The Real World Fast – Make Everybody Understand The Benefits

**Business side**
- Achieve business engagement by focusing on the particular business pain point
- Support business in understanding the output by going fast to `market`
- Make sure business understands the impact by visualizing the monetary effects

**IT side**
- Play around with features instead with models
- Need for standards
  - Prototype needs to be translated to real application
  - You do not want to rebuild everything
- Partnership founded in 2015
- RM widely used in Lufthansa
- Keeps up with market technologies
- For prototyping and productive applications
- Still lacks some software engineering capabilities …
- We pair it up with Hadoop, Oracle, Teradata, R, Python, …
- Lufthansa Industry Solutions: certified RapidMiner trainers
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Many Thanks for Your Attention!