Edison: Predictive Analytics for Sales Order Fulfillment

Hasso Plattner Institute
Enterprise Platform and Integration Concepts
Research Group of Prof. Dr. h.c. Hasso Plattner
Sales Order Fulfillment Process
Issues Interrupting the Process

During sales order processing several issues may occur:

<table>
<thead>
<tr>
<th>In Order Entry</th>
<th>In Supply</th>
<th>In Delivery</th>
<th>In Invoice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incomplete data</td>
<td>Purchasing issues</td>
<td>Shipping blocks</td>
<td>Accounting issues</td>
</tr>
<tr>
<td>Delivery blocks</td>
<td>Manufact. issues</td>
<td>Incomplete data</td>
<td>Invoicing issues</td>
</tr>
<tr>
<td>Credit blocks</td>
<td></td>
<td>Credit blocks</td>
<td></td>
</tr>
<tr>
<td>Billing blocks</td>
<td></td>
<td>Shipping issues</td>
<td></td>
</tr>
<tr>
<td>Delivery issues</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unconfirmed quantities</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

An issue usually halts the process and causes the delivery to be **delayed**.
Sales Order Fulfillment Process
Status Quo

SAP’s Sales Order Fulfillment Monitor (SOFM):

- SOFM allows for detection and categorization of current issues
- Employees then try to resolve current issues as fast as possible

Solving issues after they have occurred is often too late

Number of current issues by process step
Learn which fields and conditions caused issues by looking at
\textit{data of millions of historical sales orders}

\textbf{Predict the expected delay} whenever a new sales order enters the system

Display a list of the \textit{most pressing expected issues}

Propose the most effective action to \textit{mitigate an issue in advance}

Resolving issues even before occurring \textit{saves time and money and makes customers happy}
Predictive Analytics for Order Fulfillment Prototype

**Most effective action** to mitigate issues in advance

Process overview with expected delays by step

**Expected issues** of the currently selected process step and the data used to calculate risk percentages
Predictive Analytics for Order Fulfillment
Risk Indicators for Expected Issues

Indicating how many similar sales orders experienced the issue in the past

Sales order fields increasing the risk of an issue

Sales order fields decreasing the risk of an issue

Chart 6
Decision Trees

- Binary classification, e.g., delivery block (SO02) or no delivery block
- New orders are classified based on historical data
- Find splits which lead to homogenous groups

Chart 7
Partially Observable Markov Decision Process (POMDP)

**States:**
Issues or issue combinations, e.g.,

- $S_0$: no issue
- $S_1$: \{delivery block, billing block\}
- $S_2$: \{shipping block\}
- ...

Machine Learning Techniques
Propose Most Effective Action
Machine Learning Techniques
Propose Most Effective Action

Partially Observable Markov Decision Process (POMDP)

**States:**
Issues or issue combinations, e.g.,

$S_1$: \{delivery block, billing block\}

... 

**Initial belief state:**
Decision trees for every state determine contribution to belief state

Chart 9
Machine Learning Techniques
Propose Most Effective Action

Partially Observable Markov Decision Process (POMDP)

**Actions and transitional probabilities:**

- Actions change a sales order's state with a certain probability (and can affect multiple states)
- Performing an action influences the belief state
Machine Learning Techniques
Propose Most Effective Action

Partially Observable Markov Decision Process (POMDP)

**Rewards:**

- Actions have costs and benefits
- The reward for performing an action in a state helps to find the best action
- Costs could be delays caused by issues, contractual penalties, attorney’s fees, ...
Machine Learning Techniques
Propose Most Effective Action

Partially Observable Markov Decision Process (POMDP)

**POMDP:**
- Finds **best long term action** (not necessarily obvious action)
- Considers an action's consequences on all states
- It is therefore superior to decision rules (e.g. mitigate current most severe issue)
Predictive Analytics for Order Fulfillment
Action Proposal to Avoid Issues

PROPOSED ACTION

Mitigate Delivery Block
Show action

Delivery Block

7,755 of 7,780 similar sales orders had this issue.

Issue risk indicators
Action

This sales order was created through an automated EDI process with the customer. EDI sales orders that shared similar characteristics were error-prone in the past. You can reconfirm the sales order details with the customer to ensure everything is as desired.

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Done
Open in SAP Fiori

Chart 13
## Predictive Analytics for Order Fulfillment

### Action Proposal to Avoid Issues

<table>
<thead>
<tr>
<th>Invoicing Issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>163 of 184 similar sales orders had this issue.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Issue risk indicators</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>The department's workload has been particularly high this week. This has often caused similar sales orders to be overlooked. Consider to assign an employee who takes responsibility for the fulfillment of this sales order.</td>
<td></td>
</tr>
</tbody>
</table>

- **Alexis Smith**
  - Assign Alexis

- **James O'Brien**
  - Assign James

- **Cheng Nguyen**
  - Assign Cheng

- **Liam Colville**
  - Assign Liam

- ✔ Done

- Open in SAP Fiori

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*Chart 14*
Enterprise Platform and Integration Concepts

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