



Always one step ahead

Business is increasingly confronted with tougher competition and decreasing customer loyalty. At the same time, market conditions are changing at an ever faster rate. Stronger individualisation of marketing - in how the customer is addressed and analysed - is seen as an important tool for meeting such challenges.

For example, while over 50% of purchase decisions are made on site in the market or the branch for stationary business, the consumer goods industry invests only approx. 5% of its advertising budget in POS advertising. However, innovations in today's market are being established which increasingly automate customer interaction (kiosk terminals, PSAs/PDAs, self-checkout, etc.). Online business with its numerous personalisation instruments is thus the pioneer for the individualised customer sales approach. Completely new usage scenarios for intelligent data analysis (data mining) are produced in the process.

Data mining enables the modelling and forecasting of customer behaviour and is thus the central analytical instrument. Current data mining solutions usually still require manual operation by specialists and are based on the analysis of purely historical data. Such static approaches are not well suited to integrated applications nor are they real time capable. What is required, however, are closed loop solutions that react automatically and in real time to changes in customer behaviour and in the competition. The prudsys RECOMMENDATION ENGINE (prudsys RE) is the pioneer and market leader of this new generation of real time analytics applications.

The prudsys RE is a recommendation engine that submits appropriate recommendations for various products and users in real time. Thanks to its intelligent methods in the real time context it goes even further: it enables high quality simulations, optimisations and reports in the field of range design and pricing. In particular the dynamic price optimisation represents a worldwide innovation and opens up completely new possibilities for pricing.

The prudsys RE is intended for retailers and is meant primarily to bring about yield increase via customer interaction systems like online shops, in-store POS (kiosks, tills, scales, PSA, PDA, etc.) and call centres. The recommendation engine is multichannel-capable: analyses can be run combined over several channels and vice versa, recommendations can be submitted via several channels. The modular and open design of the prudsys RE enables the step by step and transparent tapping of its powerful possibilities, creating completely new business scenarios for customer loyalty.

RE usage scenarios in online business



- Product recommendation** - Product recommendations for individual products are generated, in particular on product detail pages.
- Search recommendation** - Appropriate recommendations are provided for a given search term. In this case we are dealing with the viewed or purchased products combined most often with the search term. The search recommendation is transaction-based and thus a valuable complement to the conventional, content-based search.
- Market research** - Product recommendations and prices are manually provided and tested in the recommendation engine. The integrated reporting of the prudsys RE then uses control groups to evaluate how successful the measures were. This generates new approaches for verifying the range and pricing policy.
- Consultants** - Virtual consultants and avatars are controlled via the prudsys RE reinforcement learning in order to optimise their consulting performance.
- Personal recommendation** - Depending on previous transactions (clicks, purchases, etc.), personal recommendations are displayed on the shopping basket or „My Shop“ page, for example. The *real time scoring module* also allows the use of user master data for highly personalised recommendations.
- Newsletter** - Personalised newsletters are created and are thus much more efficient. This is made possible by using the mechanisms for personal recommendation in combination with special features in the *newsletter module*.
- Campaign management** - The prudsys RE sends out impulses for multichannel campaign management via the *relationship management engine module*. In so doing it covers complex action chains in addition to follow-up mails with special recommendations following cancelled shopping basket processes.
- Price optimisation** - The major topic of the future! Based on clicks and purchases, the *dynamic price optimisation module* automatically varies the prices of products or categories. Special promotions and bargain shops are ideal as an entry point.
- Reporting** - The prudsys RE allows the creation of continuous, comprehensive statistics (especially when using control groups) using special log charts. These can be used via the *reporting module* for interactive OLAP analyses and automatic reports.

RE usage scenarios in stationary business



- Product recommendation** - In this case, product recommendations for individual products are generated. They are inputted by hand, scanned in or automatically detected (e.g. terminals, scales, PSAs, PDAs, etc.).
- Arrangement** - The prudsys RE simplifies meaningful arrangement of products on shelves and on topic tables. In so doing the recommendation engine interacts with special PDAs of the scheduler, which can then interactively optimise the range.
- Market research** - Product recommendations and prices can be manually generated and tested using interactive devices in the recommendation engine. The reporting integrated into the prudsys RE then evaluates the success of the measures using control groups and verifies approaches to range and pricing policies.
- Consultants** - Virtual consultants and avatars are controlled via the prudsys RE reinforcement learning in order to optimise their consulting performance (used predominantly via terminals).
- Personal recommendation** - Depending on previous transactions (inputs, scans, purchases etc.) personal recommendations are put together, which can be issued, for example, using tills with checkout couponing functions. The real time scoring module also allows the use of user master data for highly personalised recommendations.
- Campaign management** - The prudsys RE sends out impulses for multichannel campaign management via the external relationship management engine module and comprises complex action chains in addition to post-purchase loyalty letters.
- Price optimisation** - The major topic of the future! Based on sales over periodic periods of time as well as product recalls if necessary (entries, scans, etc.) the dynamic price optimisation module automatically varies the prices of products and categories. Entry via promotions, especially couponing.
- Reporting** - The prudsys RE allows the creation of continuous, comprehensive statistics (especially when using control groups) using special log charts. These can be used via the reporting module for interactive OLAP analyses and automatic reports.

The prudsys RECOMMENDATION ENGINE

Conventional recommendation engines generally function on the classic principle of data mining: they evaluate historical customer data, especially master data like transactions (clicks, purchases, etc.) and use the data to calculate models, often in the form of rules such as „the purchase of product A leads to the purchase of products B and C“, which is then used, for example, in the web shop to display recommendations.

The prudsys RE, on the other hand, learns not only from historical data but is constantly learning through interaction with the customers. This allows it to continuously adapt its recommendations to changes in purchasing patterns. Equally important is a second advantage: it strategically tests out new recommendations, thus constantly expanding its scope.

Another feature unique to the prudsys RE is that it not simply recommends the closest best product in each step but that it performs an optimisation via the chain of all possible interactions of a user in order to **maximise total sales**. This means that in some cases a product that is less profitable at the time may be recommended, if it is more likely to lead to more profitable products subsequently. Thus, the prudsys RE is geared towards the long term and is target oriented.

As a mathematical framework, the prudsys RE uses a method from the field of reinforcement learning (RL) in combination with data mining to learn about transition probabilities.



The recommendation engine can be operated in two modes: in offline mode it evaluates historical data and generates the recommendations from them. In online mode it learns from interacting with customers. A combination of the offline and online modes is best: in offline mode the engine initialises the recommendations by using historical transaction data; in online mode this data can be continually adapted and improved.

The prudsys RE comprises several layers: the tried and true business intelligence library XELOPES makes up the core, providing the preprocessing and the meta data management in addition to the analysis algorithms. On top of that is the layer of the actual prudsys RE, which realises the application logic. Sophisticated functionalities like price optimisation and reporting are supported by special modules. Connectors to external systems are also integrated. All of the interfaces for the configuration and communication of the prudsys RE are together in one unified Java API. This enables the prudsys RE itself to be incorporated as a library into third party applications, which is especially advantageous for OEM applications. Finally, an analogue service layer based on the Java API is implemented - especially for web services. This allows the seamless integration of the prudsys RE into service-oriented architectures (SOA).

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Versions/Add-on Module

Versions

Business version

The recommendation engine generates product and content recommendations. The prudsys RE is based on intelligent methods from the field of reinforcement learning and supports offline, batch online and online* modes.

Enterprise version

Expands on the business version to include features for collaboration between several recommendation engines. The RE is multi-purpose and can be used in clusters. It also contains Java APIs, web services and infrastructure for service oriented architecture (SOA). A current example of collaborative work by the prudsys RE is the use of several REs for real time learning as well as an RE for real time recommendations, where the learning REs regularly send their new models to the application REs. One further example is the use of local REs in subsidiaries which then send their models regularly to a central RE. The central RE compares the models and sends them back to the local REs, taking into consideration local recommendations.

* The term online refers to the real time mode of the RE.

Module (add-ons)

Controlling and reporting

The learning characteristics of the prudsys RE and statistics of the operative system are continuously evaluated. Thanks to numerous pre-defined reports, OLAP and geomap functions, MERKUR MINER PLUS, also a part of the prudsys RE, allows for quick analysis of this data. This makes interactive analyses on various aggregation levels and automatic reports as office documents possible. Since the prudsys RE has or collects all major master data and transaction data of the operative system, it can also be used for integrated reporting such as for web shops.

Newsletter

The newsletter module provides newsletter recipients with custom offers. Based on the clicking pattern in the newsletter and the surfing and purchasing behaviour in the online shop as well as purchase data from other areas such as offline orders or data from POS business, highly personalised offers are automatically generated for each individual recipient. Newsletters can be delivered static with fixed recommendations or dynamically completed with the link to the online shop.

Real time scoring*

This module lets you include custom customer master data for automatic customer selection and recommendations. Application examples for customer selection include optimisation of direct mailing or outbound calls in call centres, in which case sales quotas several hundred % higher and corresponding sales increases can be reached. In addition, it is possible to place individual product and category recommendations as well as ad banners and promotions using real time scoring.

Dynamic price optimisation*

Dynamic price optimisation means that product prices are varied and adapted in real time. Since the prudsys RE is constantly communicating with the users, it is the perfect instrument for getting to know customers' purchasing patterns and to react to changes immediately. The prudsys RE is thus perfect for dynamic price optimisation because the knowledge gained from it can be used to optimise prices. The result was the world's first product for dynamic price optimisation with numerous features.

* The enterprise version of the prudsys RE is required for the real time scoring module and dynamic price optimisation

Add-on module (third party)

pirobase Content Bus (PIRONET NDH AG)

As a middle layer, this add-on module takes on the task of extracting content from the individual applications and their respective data sources (content supplier) and then to make this data available to the different output formats (content consumer). On the consumer side it contains numerous connectors to POS systems (tills, scales, PSAs, PDAs, terminals, etc.), and for suppliers it has connections to important back-end systems (pirobase family, SAP, etc.) including the prudsys RE.

Relationship management engine (agentes AG)

Recommendations from the prudsys RE can be used via the Relationship Management Engine (RME) to automatically, individually and personally control campaigns using various channels. That means that customers who have cancelled a purchase process, for example, receive emails with individual offers. The RME supports automatic campaign control via various channels such as letters, emails and SMS.

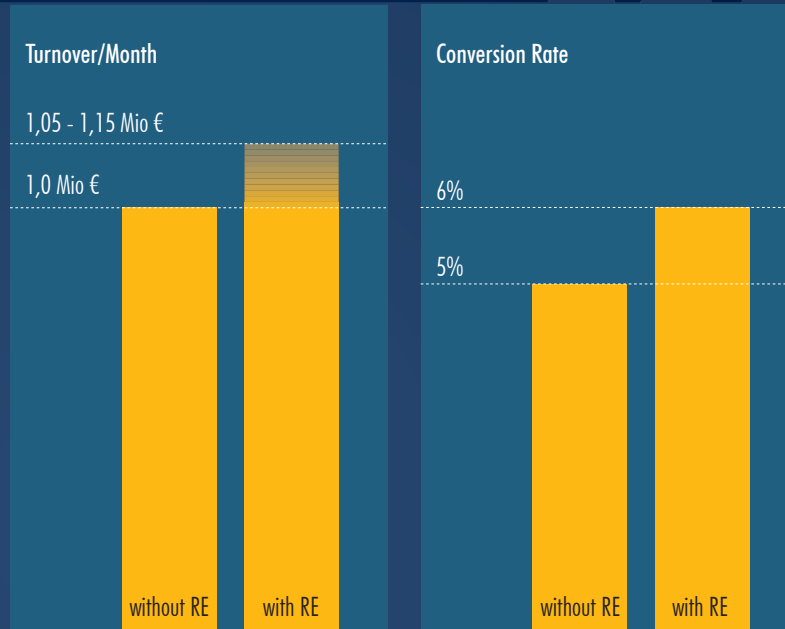
Recommendation net (ZSoft Ltd.)

The recommendation net enables visualisation of prudsys RE recommendations using interactive network graphics. The visualisation can be refined recursively. The recommendation net module is implemented for easy integration into Flash.

Benefit

The prudsys RE offers the following major advantages:

- Recommendations: 5-15% increase in turnover
- Customer selection: 50-100% increase in turnover
- Price optimisation: 5-10% increase in turnover
- Increased sales volume
- Greater customer loyalty
- Increased impulse buying
- Product promotion
- Longer stays
- Increased purchasing frequency



The prudsys RE is more than just a recommendation engine: it enables versatile simulations and optimisation measures. It can be used to simulate initial „What if...?“ scenarios: „How would my turnover develop today with product X if I reduced its price by Y? What is the optimal price for product X? What effect would changing my product line as follows have on sales?“

By submitting offers to the customer in real time, analysing responses and modifying the offers, prudsys RE identifies customer habits through practical experience and constantly adapts accordingly.

Customers and OEM-Partners (Extract)

3PAGEN

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