

The Method of Automated Monitoring of Product Prices and Market Position Determination in Relation to Competition Quotes

Monitoring of Product Prices and Marketability Development with Continuous Assessment of Market Position in on-Line Sales

Radoslav Fasuga, Pavel Stoklasa and Martin Němec

Department of Computer Science, VŠB Technical University of Ostrava, 17.listpadu 15, Ostrava-Poruba, Czech Republic

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Abstract: This article deals with the issue of automated determination of product sales price in the on-line environment. It also describes the method of calculation and the importance of global market position based on the prices and services offered. The article describes the sources where you can obtain information on the prices and marketability of the products. It describes the procedure to find the relevant products on the competitor's websites, in product aggregators and auction systems. The article describes the monitoring of price trends, product availability, promotional offers, sales and other means of sales promotion and on-line marketing. In its final part the article describes the method that based on the information obtained recommends the setting of the particular product price level, monitors the market developments and recommends the seller price changes in relation to the current state of the market. Finally, it presents an on-line application solution in which the previously described procedures are implemented.

1 INTRODUCTION

This article deals with the issue of monitoring price trends of products in the on-line environment. It describes the methods of obtaining information on price trends, competitive offers, product availability and their further processing for the purposes of gaining strategic competitive advantage in terms of sale.

One of the determining sales factors is the product price. There is a large group of customers for whom the price is the determining factor in on-line shopping. The customers prefer the lowest product price, regardless of the possible risks. They accept a price increase only provided that there is an offer of additional services: transport, service, bonuses, etc. (Zhang, Shi, Lu, 2014).

The price of products is dynamically developing in the on-line environment. There are general rules of price trends for the selected product groups. New products usually have the highest price and during the sales cycle the price is decreasing until the product is replaced by a new model resulting in a clearance sale at the lowest prices. However there

may be situations where this model ceases to apply. For example, the lack of a product on the market may increase its price or, conversely, an excess of the product can result in its price decrease. There are even products whose price is increasing with its decreasing availability on the market.

The product price may be influenced even by external factors, such as the exchange rate trends in the imported products, the commodity prices trends, the economic situation in the particular region, etc.

In the context of competitive struggle, use is very often made of the principles of special action offers, discounts, loyalty programmes and the like. Alternatively, a new seller may emerge trying to gain market share through low breakthrough prices.

With the advancement of on-line shopping and the growing amount of competitive bids, it is today virtually impossible to be manually monitoring in real-time the price developments of several products and the behaviour of the competition.

This article deals with the method of automated process monitoring of the competition prices trends not only in the area of acquiring the necessary information, but also their subsequent processing

and presentation in the form of strategic recommendations: how to handle the price of a specific product, whether to increase it, decrease it or retain at the same level (Yang, Liu, Cau, 2013).

An important part of the article is formed by the description of the method of calculating the global market position in relation to the selected relevant products. The comparison of the results with the competitors makes it possible to optimise efficiently one's own price levels and additional services.

The article describes the sources of information on the product prices. The development of prices in the course of time. Product availability and other factors affecting the sale itself.

The article also describes marginally the unfair practices used in the context of product offerings.

It describes an efficient procedure by which it is automatically identified whether the products are sold at the offered prices by the competitors.

In conclusion, the implementation of an on-line tool is described by which the set of problems outlined above is automatically resolved.

2 SOURCES OF INFORMATION ABOUT PRODUCT PRICING

This chapter provides the resources for obtaining competitive prices of the products offered. The article is generally focused on the issues of the product prices trends. The procedures described can be generalised and used also to monitor the development of the prices of services.

The sources of price information are arranged in the usual order as preferred by the customer when searching for prices and competitive offers.

2.1 Product aggregators

The first choice when searching for product prices are usually the product aggregators. On a global scale, this is the Google Products service, while regionally these are the local portals. The major market players in the Czech Republic (CR) are the Heureka.cz and Zboží.cz portals. In the Czech Republic, the advertising of products in these aggregators is subject to the payment of an official service fee. A seller who intentionally or by omission ceases to pay for these services loses the possibility of being found out for an ordinary customer. Even though he may have the best offer on the market, the customer does not know about it.

The customer searches in the aggregators based on the key words describing the product concerned, its model or variants.

In the aggregators, the products are divided into two groups of matched and unmatched products.

2.1.1 Matched Products

Matched products are those that can be clearly identified and classified by the aggregator. It is usually done based on the EAN code or the typical (unique) product name or its variant. Moreover, the matched products are also included in a specific product category and are listed in a preferential position in the search results.

Here the heaviest competition struggle for customers is taking place, which is primarily influenced by the price of the product (the main sorting criterion when listing the quotations). All the sellers are presenting the same product and except for the price, they can influence the customer only by supplementary services (value added, transport options) and by their references.

It is very important to ensure that in the offers classified in this way, the price of the product would be set at least below the average sales price.

Higher prices can be afforded only by the sellers, who have a strong commercial position, which is usually obtained after a long time of using intensive marketing campaigns.

2.1.2 Unmatched Products

There is a relatively large set of unmatched products in the aggregators. These are usually products without EAN or products with ambiguous (unequal) denomination (Zhao, Sundersan, Shen, Yu, 2013).

These products are subsequently searched for on a full-text basis and their listing in the aggregator results is only under the matched products.

Here, the seller must be very careful as regards the choice of the right keywords and phrases that will be used by the customers when searching for the particular product. These keywords and phrases must be listed in the product name and description, which is imported into the aggregator usually in the form of a XML Feed.

2.1.3 Unfair Practices in Product Aggregators

The results in the aggregators can be presented even in an unfair and incorrect manner. This conduct is sometimes caused by the malfunction of the e-shop but sometimes it is done deliberately by the sellers.

The most common misconducts include presenting false information and manipulating the keywords.

False information often means incorrect indication of the product price. In such a case, the seller usually indicates a lower price in the aggregator than that at which the product is subsequently available on the seller's website.

The second misconduct is the unavailability of the goods. The seller presents in the aggregator information about the product's being available in stock, but in fact, it is not available in the e-shop.

The third malpractice is unfair manipulation of keywords. The seller does not have exactly the featured product, but has a product that is somehow related to it. When referring to it and describing it, the seller uses the key words of a different product, and thus the product is listed in the search results of other irrelevant products (Zhang, Zhong, 2013).

It is very difficult without an automated solution to identify whether the seller uses the unfair practices deliberately or whether they are just an error in the seller's system. It can clearly be identified only after examining more items from the seller's offers whether these procedures occur recurrently or not. In the final stage, however, these unfair practices do harm to the person by whom they have been used because the customer expects the declared availability of the goods for the indicated sales price. Otherwise, the customer loses confidence in the particular seller.

2.2 e-Shop Websites

If the item of the goods is not found in the product aggregators, the customer starts to search directly in e-shops or by using website search engines (Google, Bing, Seznam). This procedure, however, is rather time-consuming. By contrast, there is a relatively big advantage that when the customers find the particular result they do not compare competitive offers.

However, it is important to know what offers, with what availability and competition prices are presented on the websites.

2.2.1 Template e-Shops

E-shops created based on customary templates or using open-source designs (Magento, Prestashop, etc.) or commercial prototype solutions are relatively easy to analyse.

Despite the different visual appearance, the internal structure of the e-shop (HTML) is usually identical or very similar. It is possible to create a

tool to browse the e-shop sites and obtain information from them about the product pricing and availability.

2.2.2 Tailored e-Shops and Individual Implementation

A problematic group of e-shops are those using their own tailored implementation solutions or those having very specific requirements for price listings, availability of goods (services) and the like.

For these types of design, it is necessary to create an individual solution that within the available website source code retrieves the areas with the required information.

In the worst cases, the text extraction methods are used within which the required information is obtained based on the identification of the appropriate text string on the webpage (for example, the page contains such words as available, in stock, etc.).

The biggest problems are with the e-shops, which offer only bulk listings of products. This means that one webpage is indicating several dozens or even hundreds of products without the possibility of displaying details about any particular product. Such lists or products can be extracted as spreadsheet tables and based on the key words or product numbers they can be subsequently matched together.

2.3 Auction Systems

A good source of the trends of product prices, as well as the marketability itself are the auction systems. Of course, here there are offers of used or unwanted goods, but still more and more sellers are apprehending the auction systems as an alternative to the sale and advertising channels. The auction systems have the disadvantage of increased costs of selling, because it is necessary to pay fees to the system operator for the bid publishing and the subsequent auctioning. These costs are negligible for products with high margins whereas the products with margins in the order of just a few percent are unsalable in this way as a matter of fact.

In terms of the analysis of the product prices trends, however, the auction systems are a very valuable source of information. We can monitor whether a product is offered at auctions or not. If a product is offered in this way, we can see the price level and whether it was successfully auctioned off (sold), what was the final sales price, how often and by how many people the bid was changed or

increased (what is the interest in the product). This information is very useful for setting the e-shop prices and represents the relevant realistic information about the marketability of the particular product (Etzion, Moore, 2013).

3 METHODS OF OBTAINING INFORMATION ABOUT THE PRODUCT PRICES

As it is clear from the previous chapter, manual monitoring of the development of product prices is possible today only for a very small set of products and competitors. For commonly sold goods, we may want to follow hundreds of products with dozens of possible competitors. It is therefore evident that this task cannot be resolved without automation of these processes (Felfernig, Jeran, Ninaus, Renfrank, Reiterer, 2013).

In the next chapter, we will focus on the description of the automation of these processes, the preparatory phase of gathering the product information and the subsequent application of such information for the purposes of retrieving and correct matching of the results obtained.

3.1 The Preparatory Phase of the Product Prices Collection

Before we start searching and automatic matching the given product, it is necessary to obtain the basic information about it to narrow the search results.

It is important to have the following information ready for reference:

- The original name of the product
- The commonly used names and abbreviations of the product
- Keywords and exclusive keywords that the customers will use when retrieving the desired product:
 - In aggregators
 - In search engines
 - In auction systems
- The price range for the product
- URL addresses to:
 - aggregators of the goods, where the product is matched
 - the particular website where the product is offered

- competitive websites, where the product is offered

The gathering of the above information is a relatively time-consuming process. On the other hand, the strategic advantage in the subsequent automated processing is invaluable.

It is clear that the product names and keywords, under which the products will be searched, can be used for automated data mining from the price aggregators, search engines and auction systems. It is also advisable to opt for the so-called exclusive keywords that may not appear with the product being retrieved. In this way, we are eliminating the possibility of confusing products of different types with similar names. Determining the product's minimum and maximum prices eliminates the possible confusion with other products or product packages or, as the case may be, products with additional accessories. It is important to modify the price interval either manually or automatically based on the continuously monitored prices.

The information about our own website provides reference information about whether and at what price the product is offered by us.

The competitive websites or, more specifically, the URL addresses leading to a specific product on these sites provide actual information about the prices at which the product is offered by the competitor, and whether the product is actually available (or, as the case may be, in what quantities). The competitive websites also need to be updated, supplemented by new competitors and the non-functional links of the existing competitors need to be updated.

3.2 Automated Data Acquisition from Aggregators and Auction Systems

Automatic machine acquisition of the above described data is dealt with in several ways. Some auction systems and product aggregators offer an application communication programming interface (API) through which it is possible to receive replies to formulated queries (in the search process). These services can be limited to a certain number of queries and possibly subject to the payment of a fee.

Many services, however, do not provide an open communication interface and it is therefore necessary to ask queries directly via the web forms of the respective aggregators. Subsequently, it is necessary to capture the generated result and to obtain the required data from it using certain programming techniques. Despite the fact that this

method is complicated and the aggregator operators are trying to prevent it (by limiting the number of queries of the respective clients), this method is very effective and brings the desired results.

If we are downloading information about the retrieved matched product, we require only one specific webpage. For the full-text results, it is necessary to eliminate the undesirable results based on more specific keywords, exclusive keywords and the price range.

3.3 Direct Product Search on e-Shop Websites

The basic question is how to get information about a specific URL address on which the reference product is presented by the competitor.

3.3.1 Getting URL Links from the Aggregators

The first source is the product aggregators, because the search results not only provide information on the availability and prices, but also a direct link to the product in the particular e-shop. This source of machine obtained direct URL links constitutes an essential basis for subsequent direct analyses (Wang, Zhang, Chen, 2012).

3.3.2 Manually Added URL Links

It is also necessary, however, to add URL links to offers of e-shops that are not registered in the aggregators. We can get to these sources by monitoring the advertising channels, social network bulletin boards, using the information obtained from customers and the like.

Then we can browse the particular website address and retrieve the relevant product in the offerings. If this website is indexed in search engines (e.g. Google), then it is possible to accelerate the process of finding the relevant website by formulating a query:

```
site:concurrency.com product_keyword
```

The `site` means the page of the competitive website and the `product_keyword` means the relevant keywords for the given product. The result provides the most likely sites for the given product.

3.3.3 Extracting the Relevant Information from the Websites

If we already have a list of URL addresses of the product for the particular competitors, it is necessary to ensure the automated extraction of the relevant information (Mikians, Gyarmeti, Erramilli, 2012).

The most important for us is the information about the sales price, whether the product is available and/or in what quantities. It is necessary to collect the information on a long-term basis and record the ongoing changes.

By monitoring the long-term changes on the competitive e-shop websites we can identify the typical conduct of the competitors. How they react to market fluctuations, which advertising and promotional techniques are used by them, whether they use incentives in the form of special rates and discounts, and/or how quickly they replenish the inventory stock, etc. (Hajli 2013).

4 DESCRIPTION OF THE DATA COLLECTED

We have to record the individual monitored products and for them their own sales prices. Then we register the competition price of the same product, i.e. the source e-shop, the valuation date, the actual price and availability. For prices, we also indicate the source from which the data were obtained (aggregator, auction, direct URL link). In regular iterations, we are going through our own e-shop, aggregators, auction systems and competitive e-shops and are monitoring the changes over time (Figure 1).

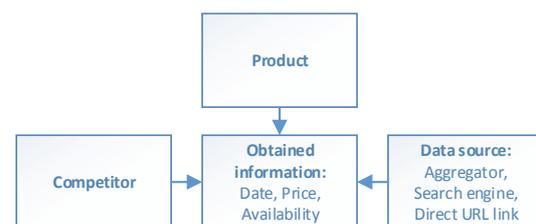


Figure 1: The obtained monitored data.

Based on the data collected in this way we can monitor the price developments of the individual products. We can keep track of the maximum, minimum, average, median and other various prices. We can set up a tracking mechanism that will alert us:

- if our price is the highest (and thus the goods are unsaleable)
- or if our price is the lowest (we can increase the price of the goods and can still remain the cheapest)
- whether we are in the optimum price range
- whether the goods are available from the competition and in what quantities
- whether a special price, discount or clearance sale price is applied to the goods by the competitors

All this information can be obtained automatically on a machine basis, without the necessity of manually browsing through a collection of links and the search results.

5 GLOBAL ANALYSES OF COMPETITION PRICES

Just as we can track the individual products and the development of their prices, we can monitor the entire collections of products.

We define therefore the products that are relevant to us. We define the significance percentage for each product, i.e. how important to us the product is within our sales portfolio. Different e-shops may have different priority products.

5.1 Calculation of the Product Price Evaluation Indicator

The next step is the setting of the rating price level, for example using again the assessment level of 0-100. The lowest price represents the best value, i.e. 100. The second step is to set up the so-called zero level, i.e. how significant is the fact that the product is not offered (is not available) by the e-shop as compared with the product's highest price. For example, if the product is not offered by the e-shop, it gets 0 points and if the product is offered by the e-shop at the highest price, it gets 50 points. E-shops that offer the product with different prices, receive a proportional number of points in the interval between 50-100 points according to their prices (where 50 represents the highest and 100 the lowest price).

Other factors that may influence the evaluation of the product can be defined as penalty points, which will reduce the product rating for the

particular e-shop. Typical examples for penalizing are as follows:

- the goods are not in stock - only on request
- the goods cannot be taken away by person
- the goods cannot be sent on the cash-on-delivery basis
- the goods cannot be paid by cash, by bank transfer, by credit card
- the goods are available only based on inconvenient modes of transport

The entire pricing process can be seen in the following flowchart (Figure 2).

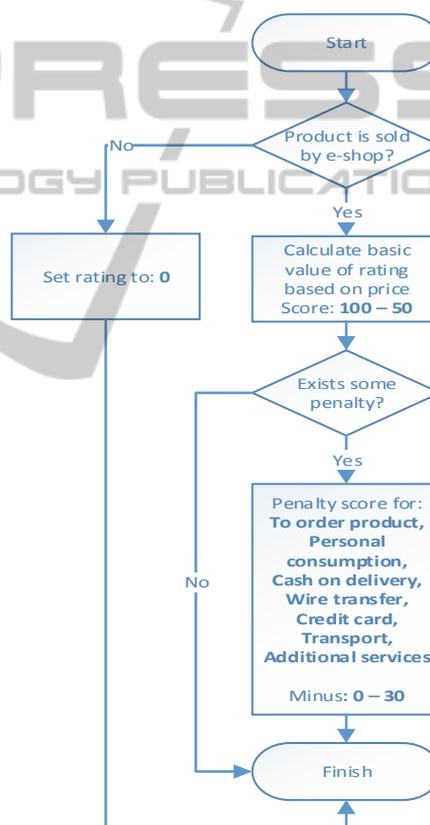


Figure 2: Product rating flowchart.

5.2 Market Position and Its Analyses

If we multiply the above result by the significance percentage and sum up these results for all the relevant products defined by us, we get the assessment of our offer and the offers of the competition, where the higher score represents a better result. By sorting out the list of competitors in

accordance with the calculated criterion, we get the current market position (Elakehal, Padget, 2012).

Using the comparative analysis, we can compare our position with the best competitors. In this way we can find out in which attributes and values we are lagging behind. Subsequently we can work on these indicators and correct them.

We can also use the so-called differential analysis, where we try to identify the areas in which a few or no competitors are active. If these areas are relevant to our customers, we can offer them new options and services.

5.3 Frequency of the Market Position Analysis

Just as it is important to update regularly the development of the product prices and availability, it is necessary to upgrade the market position rating.

It often appears that the competition is doing nothing and that their changes at the level of partial products are negligible, but still they can be of great importance on a global scale.

Our monitoring has shown that small but regular changes and sensitive price adjustments (not only price reductions, but also price increases) of the products are much more efficient in the long term than dramatic actions, discounts and clearance sales. The sellers who sell at discount prices are losing their own profits and often have to sell much more to achieve the same profits as those who sell without discounts, not to mention the increased costs of distribution, complaints and similar services.

In the on-line solution implemented by us, the users can define the relevant products, product groups and all the criteria described above.

This is subsequently followed by the process of gathering the necessary data and generating detailed reporting assemblies, both to determine the global market position and to identify the position of the individual products.

In addition, the system offers the possibility of defining the control and decision-making rules, where it is possible to define the conduct of an expert, who based on the selected sales and marketing strategy may recommend the appropriate corrections to the prices and services provided.

6 THE METHOD OF MARKETABILITY RATING

The most common user question is: Whether and at what price the product is sold? The answer to this question can be found in the process of monitoring the product sales prices and their availability. The evaluation principle is relatively simple.

If in the previous iteration, the e-shop did not have and offer the product in stock and now it has in stock, it cannot be predicted whether the given product was sold in the meantime and at what price.

If in the previous iteration the e-shop offered the product in stock and now the product is out of stock, it can be assumed that in the meantime the product had been sold for the formerly ?withdrawn? (adjusted) price. The same applies if the e-shop indicates on its website a certain number of available products and this number changes again (decreases) downwards.

A problem may occur in the case when the number of products to be sold changed (decreased), but the price in the given period has also changed (increased or decreased). Then we cannot say with certainty whether the product was sold for the original price or for the current price (Figure 3).

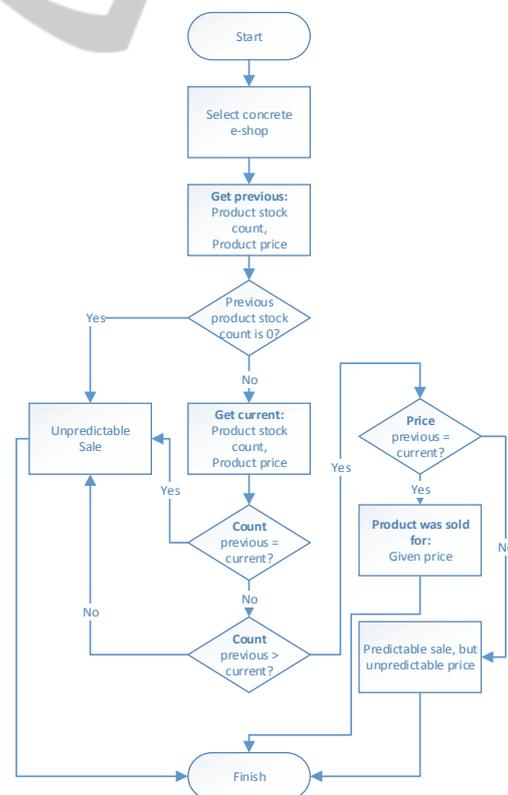


Figure 3: Marketability flowchart.

In the chapters above, we have also indicated how to obtain information about sales within the auction systems.

7 DESCRIPTION OF THE IMPLEMENTATION

The procedures and methods described above have been experimentally implemented within the specific research of the Mining University (VŠB), Technical University of Ostrava.

The implementation section is divided into the so-called crawler layer that continuously retrieves data from product aggregators and auction systems and accesses the e-shops as such. This layer is implemented as a multi-threaded Java application. MySQL was chosen as the primary database for the storage of downloaded data as well as the calculated intermediate results.

7.1 Extraction of Relevant Data

After the data have been downloaded, they are extracted, both of the websites obtained from the aggregators, where the sets of records are extracted, as well as from the specific e-shops.

There are import templates defined for each e-shop that describe the structural content of the website and are able to extract effectively the desired information. The tool allows to analyze new websites, load new structure and in a visually acceptable form (without knowledge of the implementation of website presentations) to define the places where the relevant information (prices, availability, etc.) is located. The system is also able to manage identification of multiple variants and product prices within a single webpage.

7.2 Presentation Layer

The presentation layer is implemented over the PHP technology with the Nette framework (with respect to the choice of the open source software). The HighCharts component is used for the presentation of graphs. The initially intended visual representation using the responsive CSS Framework Metro UI (Figure 4s) was replaced with the ACE template comprehensive solution based on Twitter Bootstrap.

The presentation layer also includes the ability to export the results in the CSV, XLS, XML formats for additional processing.



Figure 4: Marketability flowchart.

7.3 Optimization, Deduplication and Security

In the context of the analyses conducted, there are works carried out even for relatively small projects with large amounts of data in terms of their transmission, processing, subsequent storage and reasonable reporting.

Here, an important role is also played by the continuity and smoothness of the process of obtaining information because failures in the downloading process cannot be replaced by anything, because pricing is a constantly changing dynamic process.

For the projects, it is also necessary to deal with the query deduplication over the product aggregators, auction systems and the sales websites. It is very likely that the system will be also used for analyses by competing projects, which would want to evaluate each other. It is necessary to eliminate duplicate requirements and especially to prevent the possible abuse of the resulting analyses.

Each user brings into the system part of their personal knowledge and experience with a given market segment. They propose their own assessments and metrics for comparing the projects. It is therefore necessary to ensure thorough security

and backup of user accounts to prevent the stealing of such critical information.

7.4 Objectives of the Implementation and the Related Modules

At present, the application is fully localised in the Czech language and is oriented on the Czech on-line sales environment. The extension of the scope of operation is being prepared for the future within the European Union.

The entire solution should be integrated into a comprehensive solution, which - besides solving the pricing policy and the price developments - will also deal with the other aspects of on-line commerce, such as monitoring the positions in search engines, SEO optimisations, finding similarities within the same or competing websites, analysis of backward references and operation on social networks. The system is implemented on a modular basis so that partial results of the different modules can be mutually combined and assessed.

The system can also integrate external data sources, such as foreign exchange lists, commodity prices developments, demographic data and sociological or statistical results.

8 CONCLUSIONS

The principles and procedures described herein are reflecting the current state of the development of the tool for the analysis of competitive quotations and the determining of global market positions. All the results published herein have been verified in practice under real projects. Currently, a pilot launch of the project is under preparation for the public. The project is oriented with its focus on small and medium-sized entrepreneurs who do not have enough time and human and financial resources to analyse such large collections of data. The implemented system should automate and streamline this entire process and make it available for any common user.

We will welcome any comments, suggestions for improvements or opportunities for cooperation and joint research in this practice-oriented field of e-commerce. The aim is to give the ordinary users comprehensible facts, which will help them streamline and further develop their business.

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