# Supporting Product Optimization by Customer Data Analysis

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**Abstract** This paper introduces a concept for product optimization support based on the integration of customer data sources. The motivation is a common misunderstanding gap between the manufacturer and the customer. While the customer has certain needs, the manufacturer aims at embedding them into the product design. However, due to imprecise understanding of the needs and subsequent development mistakes, the product can vary from what the customer actually requires. The concept combines two different data sources in order to reveal the gap between the product and the customer needs. The first source is represented by a customer-product interaction log file. The second source is social media delivering customer feedback regarding the product.

## 1 Introduction

Designing a product that satisfies the customer is a major goal in any manufacturing field. However, due to inaccurate identification and interpretation of the customer needs, as well as subsequent development mistakes, the product delivered to the customer can vary from what he requires. We can distinguish the following categories of the product non-compliance to the customer needs:

- The customer cannot reach his goal with the product. The required functionality is either not implemented or unavailable due to malfunctioning or other reasons;
- The customer can reach his goals with the product. However, some other aspect of the product does not meet the customer needs. For example, the customer finds the

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product too slow in operation or not visually attractive. Some of the functionality provided by the product can be not needed.

The task of product optimization is to minimize the gap between the product and the customer needs. Corresponding product optimization steps can include modification of the product appearance, elimination of non-demanded functions, introduction of new functions, etc.

In this paper we suggest a concept to support product optimization. The concept aims at discovering the gap between the product and the customer needs by integrating several data sources. The first source is represented by a structured customer-product interaction *log file*. The second source is *social media*, providing customer feedback about the product in a natural language form.

The remainder of this paper is structured as follows. Section 2 describes used data sources. The proposed concept is presented in Sect. 3. Section 4 summarizes the paper and provides an outlook to future work.

## 2 Customer Data Sources

We consider the system consisting of the product and the customer interacting with each other. The interaction is guided by the customer goal. People naturally communicate in multimodal nature: by means of spoken language in combination with gestures, mimics, and nonlinguistic sounds [2]. The same holds for the customer interaction with some products [7], so the interaction can involve different modalities.

We assume that the product non-conformity to the customer needs influences the way the customer and the product interact. Therefore, customer-product interaction analysis can be used for the product optimization. Related concepts include human performance analysis [3, 6], descriptive statistical analysis, sequential pattern mining, profile analysis [8], quality management [1] and others. Within the concept we consider the structured *log file* as a source that represents a detailed tracking of the actions taken by the customer and the product.

The knowledge about the state of the customer's mind is important to understand the customer interaction with the product and detect the product non-conformities. The human mind can be considered as a system, consisting of the following subsystems: perceptual, cognitive and motor one [4]. The perceptual subsystem carries sensations of the physical world. The cognitive subsystem connects perceptual and motor subsystems. Finally, the motor subsystem translates thoughts into actions. We consider voluntary customer feedback, expressing concerns regarding the product, as a source of knowledge about customer perception and intentions. *Social media* is selected as one of the most prominent sources of the customer feedback. The source comprises customer text messages from Internet blogs, discussion boards, social networks, etc. Related work include topic detection, sentiment analysis, summarization [5] and others.

## 3 Concept for Product Optimization Support

We suggest the concept integrating *social media* and *log file* to reveal the gap between the product and the customer. The concept facilitates detection of the product aspect non-complying with the customer needs.

### *3.1 Concept Overview*

The concept overview is presented in Fig. 1. The customer and the product interact with each other. The interaction can be influenced by a wide range of factors, like the weather, geographical location, the customer health condition, etc. The interaction is tracked and recorded in the structured *log file*. At the same time, the customer voluntarily provides his feedback about the product in *social media*.

Data acquisition and preprocessing are left outside the scope of this paper. The analysis of the data sources implies completion of the following interconnected tasks:

- Detect common deviations of customer-product interaction from the manufacturer anticipations. Such deviations can be considered as possible indicators to the product non-compliance to the customer needs;
- Reveal common concerns expressed by the customer with regards to the product.

The output of the above mentioned tasks can be integrated in order to generate the hypothesis regarding the product aspect non-complying with the customer needs. The generated hypothesis can be confirmed or rejected by performing customer surveys

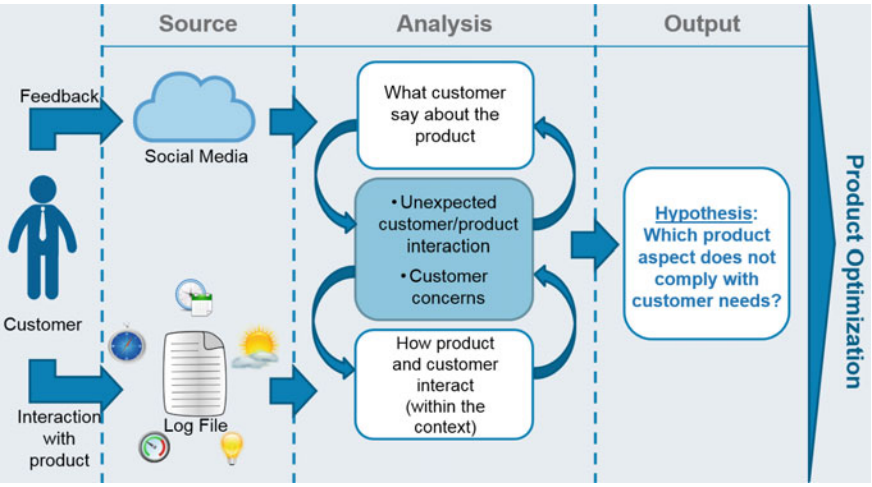


**Fig. 1** The concept overview

or by consulting domain experts. If the hypothesis is confirmed, it can be used to support the product optimization.

## 3.2 Log File and Social Media Analysis

This section describes how the tasks can be completed. The *log file* is used to detect customer-product interaction deviating from the manufacturer expectation. Here the interaction is considered from the manufacturer perspective. Thus, the definition of the deviation is dependent on the business context.

The customers can be clustered according to their behavior. Each of the clusters can be analyzed independently. The interaction can be also considered within the relevant context. Simple examples of metrics used to detect unexpected interaction are function or interface element usage frequency or duration. The baseline for such metrics can be either predefined by the manufacturer or generated based on the results of different periods, functions, customers, etc. Advanced analysis can include sequential or frequent pattern mining, revealing unexpected combinations of steps frequently taken by the customer.

*Social media* analysis considers customer messages and therefore provides the customer view. The analysis can be supported by the derivation of structured information like words and relations between them. This could be achieved by applying associated rule mining against a set of importance metrics, as well as by other methods. Here we base on an assumption that frequent usage of the same words in one message indicates customer concerns. Based on the results of the analysis, the knowledge about common customer concerns can be gained. Social media can also describe the relevant context.

## 3.3 Integration Schema

In order to combine the unexpected customer-product interaction and customer concerns, a common integration structure is required. We suggest the following common set of dimensions:

- *Criteria* defining the product aspect deviating from the customer needs. The criteria can include functionality, reliability, performance, usability, security, understandability, design aesthetics, etc.;
- *Function* defining the logical block of product functionality that does not meet the customer needs against some of the criteria;
- *Modality* defining the way of customer-product interaction (by voice operation, gestures, etc.). The modality can deviate from the customer needs against some criteria as well;
- *Context* of interaction defining factors influencing customer-product interaction.

Analysis of both the *log file* and *social media* can be performed in accordance to the suggested schema. The mapping can be supported by introducing a common vocabulary. This way, the concepts from each of the sources get assigned to the common function, modality, etc.

### *3.4 Concept Illustration*

This section provides some examples of generating the hypothesis regarding the product aspect non-complying with the customer needs. The hypothesis is created based on the integration of unexpected customer-product interaction and customer concerns.

We first consider the situation when the customer cannot achieve his goals with the product. In this case *social media* analysis is expected to reveal corresponding customer concerns. The *log file* analysis can find corresponding deviations in the customer-product interaction. This could be multiple attempts of the customer to find or launch the required functionality, as well as a search for possible workarounds. Product optimization would include implementation of the lacking functionality.

The second category covers the situations when the customer can reach his goals with the product, but some other product aspect does not fit his needs. For the first example let us assume that the *log file* analysis shows that the product function is operating more slowly than it is expected by the manufacturer. This finding can indicate that the function performance is non-complying with the customer needs. If corresponding customer concern regarding the function speed is present in *social media*, the product performance should be considered as a subject for optimization.

Another example is unexpectedly rare usage of some function detected by the *log file* analysis. If the *social media* analysis detects no corresponding customer concerns, the functionality can be considered as redundant. Alternatively, the concerns from *social media* can show that the customer finds the product not attractive or hard to understand. Corresponding product optimization steps can remove the non-needed functionality or modify the product interface and appearance.

Finally, if *social media* reveals that the customer does not reach his goals with the product and *log file* analysis shows that corresponding functionality is not used, the customer can be unaware of it. In that case the product understandability should be improved.

## 4 Summary and Outlook

In this paper we presented the concept to discover the knowledge about unexpected customer-product interaction and customer concern regarding the product. Integration of the findings helps to generate the hypothesis about the product aspect

non-complying with the customer needs. This facilitates exploration of the gap between the product and customer needs and supports product optimization.

For perspective development of the concept methods of semi-automatic implementation will be explored in details. Methods of mapping the findings from each of the sources to the common integration schema, as well as ways of hypothesis generation support will be explored. Sentiment analysis can be implemented in order to incorporate the emotional component of the customer feedback.

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