

Title	製品設計のためのユーザー要求抽出と文化的属性に関する研究
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## 論文の内容の要旨

### Research Content

User requirements play an important role in Product design. The requirements can be used to help designers to determine the product's features for the design process. Besides, it can be considered as the goal for designers in designing products. Current approaches to obtaining user requirements usually use some traditional methods such as surveys, questionnaires, and interviews. These methods can gain some important information about products by interacting with customers. However, the methods have some drawbacks as described as follows: First, it is clear that obtaining the user's information in such a way is expensive. Also, it is difficult to obtain a large number of users' information due to the limitation of accessing a large number of users. Furthermore, sometimes we cannot get their real emotions, and the obtained information could not reflect all aspects of what users need. Meanwhile, the information about products on the internet is available and growing rapidly. The information comes from a very large number of users in different cultures. This information is an essential knowledge for the new users when they would like to purchase the product. Thus, it is essential information for designers in designing attractive products for users. This thesis presents a method for bridging user requirements to designers in Product design. The motivation behind this method is that user requirements are automatically collected by performing an opinion mining method on a set of online product reviews, which is available on the web. The user requirements are then provided to integrate with designers.

In the thesis, we investigate various ways to extract user opinions from customer's opinions for designers in terms of designing products. The main contents of the thesis are sketched as follows.

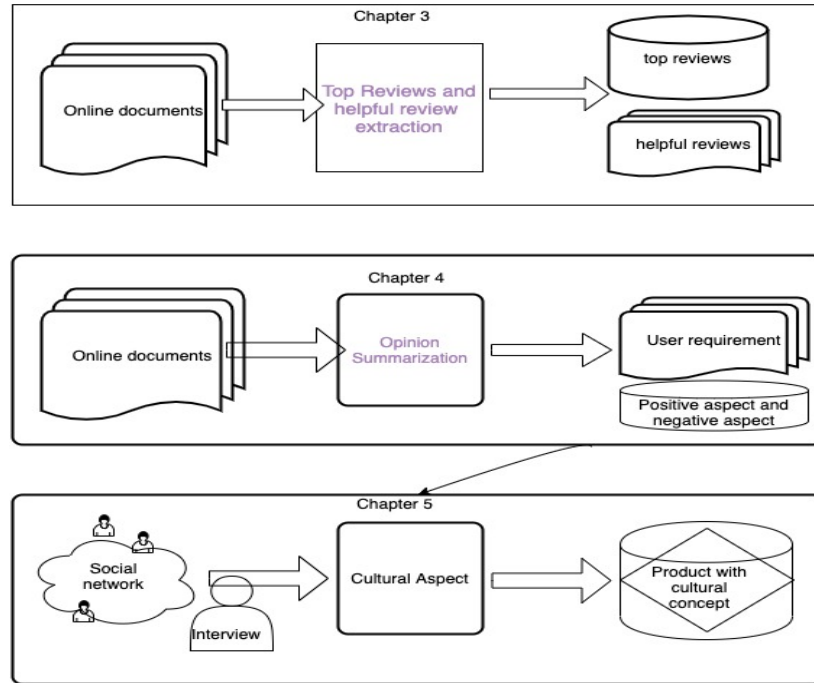


Figure 1. The structure of the thesis

Chapter 3 investigates a study on verifying the contribution of top reviews and helpful reviews on product design. We applied advanced machine learning models to identify helpful reviews automatically and exploit the contribution of helpful reviews on the designing process. From a technical point of view, we compare various machine learning models to select the appropriate one for helpful review identification tasks. We evaluated our results with designers to understand the perspective of designers when they use helpful reviews.

Chapter 4 proposes a user requirements extraction framework that can solve the following issues: (1) extracting aspects of products (2) summarizing reviews opinion corresponding with aspects and (3) classifying them into positive and negative categories. We propose supervised learning and unsupervised models for extracting aspects automatically. Experimental results on the benchmark data showed that the proposed method attains high accuracy compared to strong baseline models. Chapter 4 proposed a novel method using opinion summarization techniques, along with the uses of keyword and aspect extraction, to obtain user requirements.

In addition to that, we investigate various machine learning and deep learning models for sentiment classification to classify customer reviews into positive and negative. Some case studies for evaluating the use of user requirements with designers are carried out. The results of the questionnaire by interviewing with designers showed that the proposed framework is sufficient for supporting designers in the early phase of

product design.

Chapter 5 shows our third contribution by considering the cultural attributes and their impact on product design in the early process of product design. We also investigate how cultural attributes can change and effect on selecting design concepts. A case study with designers showed the contribution of cultural attributes and user requirements in product design. The results showed that cultural characteristics and user requirements could help designers create new concepts for culture-oriented product design.

### **Research Purpose**

This research aims at studying the bridge method of utilizing user feedback from online customers for supporting designers in terms of designing products. The research also focuses on answering how cultural attributes can contribute to the design process and design creativity.

More precisely, we aim at tackling the problem of utilizing user feedback to support designers in terms of designing products. There are many reviewers available on the internet, but we would like to focus on top reviews and the helpfulness of reviews for product design. For regular reviews, we perform the uses of opinion summarization techniques to get user requirements and form it into an appropriate format for designers to support them in terms of designing products.

On the other important aspect, we aim at studying how cultural attributes can combine with user requirements for supporting designers in the early phase of product design. For this purpose, we would like to interview with designers from various countries to understand the contribution of cultural attributes to product design.

### **Research Accomplishment**

1. Kieu Que Anh, Yukari Nagai, and Minh Nguyen, "Extracting Customer Reviews from Online Shopping and Its Perspective on Product Design", Vietnamese Journal of Computer Science Vol. 6 No. 1 (2019) 43-56
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3. Kieu Que Anh, Yukari Nagai, Cultural-Oriented Product Design: A Case Study for Vietnamese Product, In Proceedings of KICSS 2019.
4. Kieu Que Anh and Yukari Nagai," Extracting User Requirements for Product Design: A Supportive Framework for Designers, In Proceedings of Redo 2017, pp 594-760

5. Kieu Que Anh, Yukari Nagai, and Minh Nguyen, "Extracting Customer Reviews from Online Shopping and Its Perspective on Product Design", In Proceedings of KICSS 2017 conference, Nagoya, Japan
6. Kieu Que Anh and Yukari Nagai, A Vietnamese culture framework for Product Development, JAIST World Conference: Advanced Design Creativity Track (JWC 2019)

Keywords: Product Design, User requirements extraction, Cultural Attributes, Opinion Mining, Helpful review identification

### 論文審査の結果の要旨

アイデア創出の支援方法の一つに使用者（ユーザ）の評価を参照させる方法があり、学術的にも社会的にも普及しており、その一環として従来はマーケティング調査が行われていた。しかし、現代においては急速なインターネットの普及により、オンラインショップなどでは利用者が直接、評価を入力することができるようになった。本研究は、今日のインターネット環境で流通される製品を主な対象として、そのプロダクトデザインにおけるアイデア創出を支援することを目的に、一般ユーザの評価や意見を先導するトップユーザ・オピニオンの役割に着目し、ユーザの要求情報をデザイナーにフィードバックする推薦システムを考案した研究である。システムの設計と Web 上での利用が可能になる仕組みを構築し、プロダクトデザインの場合には、機能性以外の項目がデザイナーの発想に役立つという洞察から、それを実現する方法を検討した。その際、膨大なレビューコメントから、デザイナーから見て有用なコメントをどう合理的に抽出し、要約するかが課題となる。従来の手法を調査するうえでは、一般に普及している既存のレビュー表示システムの背後にあるアルゴリズムの詳細な検討を経て、感情を考慮した手法として BERT 手法を導入することで、高精度の要求抽出に成功している。電子ショッピングサイトのユーザレビューを知識源とし、機械学習によりユーザ要求を抽出し、重要度を計算する新しい方法の可能性を見出し、2 種類の異なる製品カテゴリーで実際のレビューを題材に比較し、分析を行った。

提案したシステムによりユーザ要求の参照情報を 50 名のデザイナーに使用してもらい、アイデアを創出する実験を行い、ベトナム、中国、日本の文化的属性の影響について、アンケートとインタビューによる調査の結果として報告している。結果からの考察で、ユーザのレビューにおいて、特に文化的な特徴に関した情報が与えるプラスの影響を見出した。

今日、世界中の人々がアクセスするショッピングサイト等のインターネット利用により大規模なソーシャルデータが入手可能であるが、日々表出されているユーザ要求の膨大なデータを活用するうえで、より賢く抽出し、デザイン等の創造的活動に役立てようという知識科学の視点を生かした研究であり、社会的な有用性が認められる。また、提案された手法は汎用性があり、プロダクトデザイン以外への応用についても、将来的な実用可能性が示されている。

以上、本論文は、トップユーザ・オピニオンの役割に着目し、プロダクトデザイナーにフィードバック

する推薦システムを提案したものであり、学術的に貢献するところが大きい。よって博士(知識科学)の学位論文として十分価値あるものと認めた。