POVeye: Enhancing E-Commerce Product Visualization by Providing Realistic Image Based Point-of-View

Shogo Yamashita
Rakuten Institute of Technology, Rakuten Inc.
The University of Tokyo
qq146419@iii.u-tokyo.ac.jp

Adiyan Mujibiya
Rakuten Institute of Technology, Rakuten Inc.
4-13-9 Higashi-Shinagawa, Shinagawa-Ku, Tokyo
adiyan@acm.org

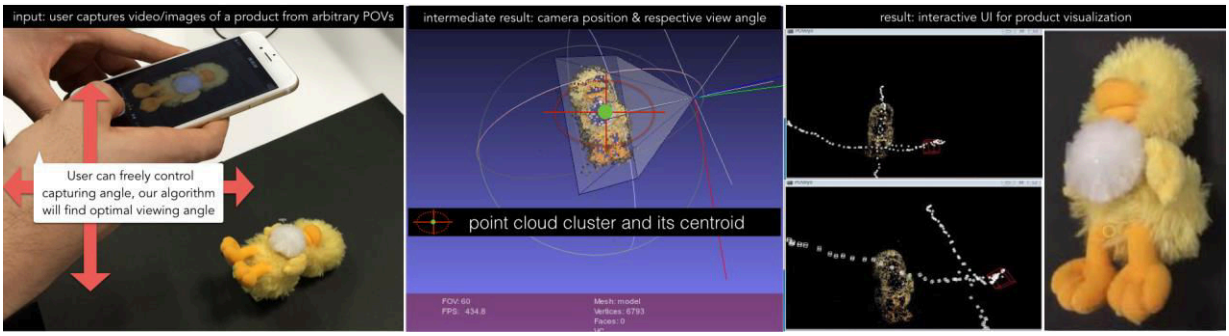

Figure 1: We propose POVeye, a user interface solution that enables extensive visualization of multiple viewing angles of a product that can provide representative description of its material color and texture. We focus to minimalize user input task, and to provide interactive visualization of the product that can be easily embedded into standard web platforms.

ABSTRACT

We present POVeye, a method to help users in capturing and creating visualization of products for extensive representation of the product's material color and texture. POVeye achieve this by providing realistic images captured from various angles, which are positioned correctly based on the calculated geometrical centroid. As input, users simply provide a video or multiple images of the product taken by any camera from arbitrary angles, without requiring any pre-calibration. POVeye provides an interface that shows object-centric camera positions alongside with image taken from respective camera angle. Users are able to either manually browse through automatically detected camera positions, or visualize the product by automatically detected view-angle path. POVeye leverages Structure-from-Motion (SfM) approach to obtain camera-object map. Our approach is unique from other solutions by preserving realistic imaging condition. We observe that visualization of products from different angles that provide information of light reflection and refraction potentially helps users to identify materials, and further perceive quality of a product.

Author Keywords

Visualization; material texture; view angle; e-commerce.

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ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION

Complex real lighting conditions and viewing angle effects on material color and texture are highly relevant aesthetic features of a product. This particular aspect has been proven to have strong impacts on customers' perceived quality of a product. For the e-commerce industry, representing a product's visual information through images are crucial, as costumers' decision process involves perceived visual information. Moreover, misleading visual information or excessive usages of subjective text descriptions potentially cause costumers to hesitate buying online, or return the delivered merchandise due to mismatched expectations. Overall, this may cause bad user experience, pose negative marketing for merchants, and increase operational costs.

SfM based approaches have been widely used to obtain 3D model of objects [1,2,3]. Depending on the input quality, the aggregated point clouds are often very sparse. To obtain usable 3D model for better object's representation, point clouds and texture inpainting are often required. However, it causes significant information loss on lighting effects. In this work, we create an interface design to provide realistic visualization of the object relative to its viewing angle and lighting condition without any post-processing or rendering.

We introduce POVeye, a user interface solution that enables extensive visualization of multiple viewing angles of a product that can provide representative description of its material color and texture. On the basis of the state-of-the-art in SfM approach, this paper describes a visualization

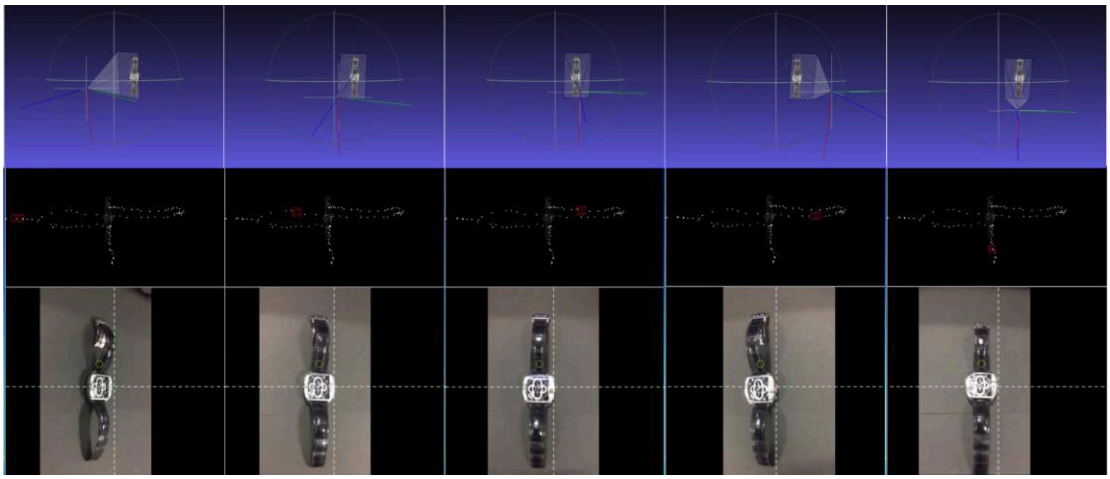

Figure 2: Visualization example for a wristwatch, which has glossy metal surface, leather texture, and glass dial cover. Users can intuitively navigate through the viewpoints using computer keyboard's arrow keys and mouse. POVeye uses static geometrical centroid to keep stable alignment for images from different angles (illustrated in the bottom part of the figure).

approach that only requires minimal user actions which involves video or multiple images capture using any camera from arbitrary angles. POVeye software implements basic SfM and further extends it to: 1) obtain key image frames that represents correctly detected viewing angle achieved from 2D features matching, 2) obtain camera-object 3D relative position map, 3) obtain object's center-of-geometry that serve as visualization's pivotal point, and 4) obtain optimal camera viewing trajectory to produce automatic animation that can be easily portable to standard web page as gif or motion jpeg. In this work, we contribute to HCI community by presenting our user interface design concept, prototype implementation details, as well as brief evaluations of POVeye. We also discuss limitations, and share our plans for future iteration of this work.

POVEYE IMPLEMENTATION AND EVALUATION

POVeye consists of two main components: 1) implementation of SfM approach, and 2) user interface part which provides interactive visualization of the product. We highlight our approach in Figure 1. In order to give better visual information in each viewing angle, we designed POVeye UI to have a static pivotal point of the object, i.e., the point of origin where x,y,z-coordinates are {0,0,0} should be the same across images. We define this static pivotal point as the center-of-geometry (i.e., centroid or barycenter) calculated from the aggregated 3D point clouds, which we treated as the centroid of a finite set of k points $x_1, x_2, \ldots, x_k$ in R^n [4]:

$$C = \frac{x_1 + x_2 + \cdots + x_k}{k}$$

The centroid C minimizes the sum of squared Euclidean distances between itself and each point in the set.

To evaluate the effectiveness of our approach, we experimented our visualization method on different material types such as: 1) plush toy: thick soft fabrics object, 2) wristwatch: glossy metal surface, glass dial cover, and leather texture on the strap, 3) the back of a champagne-gold iPad (with glossy logo). We depicted our visualization approach in Figure 2.

DISCUSSION

Users are able to tell the difference of certain materials by observing different light reflections and/or refractions in images captured from certain viewing angles. As an example, in the wristwatch visualization, users are able to easily obtain information on how the metal, glass, and leather's look and feel change relative to illumination and viewing angle. Using the simultaneous camera-object visualization, users are given awareness on the distance and angle of the camera relative to the object. Therefore, users are provided with better representation of the actual product's visual information to help their decision process.

CONCLUSION AND FUTURE WORK

We presented POVeye, a user interface solution that enables extensive visualization of multiple viewing angles of a product. The visualization also provides intuitive 3D map of camera-object relative position to give users full awareness of the image spatial contexts. We reported our implementation approach and visualization results of several representative objects. In future iteration of this work, we plan to improve towards more effortless capture and refine the UI. We also plan to conduct rigorous user study to evaluate effectiveness of POVeye approach, and to provide design guidelines for other researchers and practitioners who are interested in applying our solution.

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