A visual tool for reducing returns in e-commerce platforms

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Returned products are one of the main problems of online shopping.

Globally, about 36% of online shoppers return some or all their online orders and less than half of them are re-sold at full price.

Within the EU alone, around three billion purchases are returned to the retailers per year, with huge economic and environmental costs.

- Financial reconciliations
- Restocking
- Repackaging
- Remarketing
- Shipping services
- Increasing CO2 emissions
According to UPS, the second most common reason for returns is that the product is different from the textual description and images provided by retailers.

Online shoppers can only rely on product descriptions, images, and reviews of other customers.

Product dimensions can be misleading:
- Not all people can figure them out from the description.
- Products are shown on a white background without any reference nearby to understand the true dimensions.
CompareDimensions is a software tool aimed at supporting customers in understanding the real dimensions of the products they are about to purchase.

Returns due to unexpected or incorrect dimensions could be significantly reduced, which results in fewer economic losses for retailers and a reduced impact on the environment.

Main functionalities:
- Customers can compare product images with well-known references from everyday life (e.g., a man, a child, a chair, a door).
- Images can be moved and measured using a Cartesian plane whose dimensions can be shown in different units of measure.
**Existing solutions**

- **PiliApp** and **Pective** are websites that provide a huge set of product images. Objects are displayed in full-size and resized according to the screen characteristics.

- **Compare Sizes** is a website that allows a side-by-side comparison of multiple objects, represented as 2D boxes, by manually specifying their dimensions.

- **Phone Sized** is a website for comparing the relative dimensions of mobile phones and tablets.

- **Next to a person** is an Amazon plug-in that compares product images to an average sized person.
CompareDimensions: main steps

**Dimensions extraction & validation**

- **Material**: PU Leather Wood
- **Color**: Black
- **Form Factor**: Adjustable Bed
- **Item Dimensions**: LxWxH 69 x 33 x 30 inches
- **Assembly Required**: Yes

**Product visualization & comparison**

**Image collection & processing**
Dimensions extraction & validation

- Product dimensions are extracted through pattern matching from the HTML page.
  - Most common numerical pattern: $n_1 \times n_2 \times n_3$
  - It is followed by a literal pattern that specifies how to interpret these measures (e.g. $L \times W \times H$).
  - If no literal pattern exists, the dimensions will be interpreted according to the $L \times W \times H$ pattern.

- The procedure was successfully tested on structured e-commerce sites such as Amazon, eBay, and Alibaba.

- Main issues:
  - A malformed literal pattern is provided in the description by the retailer.
  - The package dimensions are specified in place of product ones, and the difference may be not negligible.

<table>
<thead>
<tr>
<th>E-commerce</th>
<th>Total products</th>
<th>Hit rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amazon</td>
<td>100</td>
<td>97%</td>
</tr>
<tr>
<td>eBay</td>
<td>100</td>
<td>95%</td>
</tr>
<tr>
<td>Alibaba</td>
<td>100</td>
<td>94%</td>
</tr>
</tbody>
</table>

Dimensions extraction for different e-commerce sites
Product images are collected keeping only those in high resolution.

Product images usually have a white background and often an outer frame, which can lead to an incorrect resizing.

The procedure removes the background to get only the cropped representation of the product.

- It iterates over the pixel matrix of the image identifying the background regions to be removed.
- The minimum sized frame that contains the product is found.
- The obtained product representation is resized according to the dimensions found in the previous step.
Product visualization & comparison

- Product images are compared side-by-side with different references.
  - References are well-known images from everyday life.
  - The user can change the reference and the product image to make the necessary comparisons.
  - The user can add Cartesian axes with measures in centimeters or inches.
  - Product dimensions can be manually modified and images can be moved.

<table>
<thead>
<tr>
<th>Name</th>
<th>Height (cm)</th>
<th>Length (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>man</td>
<td>175</td>
<td>54</td>
</tr>
<tr>
<td>woman</td>
<td>165</td>
<td>45</td>
</tr>
<tr>
<td>teenager</td>
<td>150</td>
<td>40</td>
</tr>
<tr>
<td>child</td>
<td>100</td>
<td>32</td>
</tr>
<tr>
<td>newborn</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>school chair</td>
<td>95</td>
<td>50</td>
</tr>
<tr>
<td>kitchen chair</td>
<td>82</td>
<td>40</td>
</tr>
<tr>
<td>door</td>
<td>210</td>
<td>80</td>
</tr>
</tbody>
</table>

Main references for product comparison
The effectiveness of the proposed tool was assessed using Amazon as a testbed.

We implemented the proposed tool as a Google Chrome extension, available at https://github.com/SCAlabUnical/CompareDimensions.

Experimental evaluation was carried out through the administration of a survey.

- A set of 100 products was selected from the Amazon website.
- The survey was submitted to a sample of 100 users.
- Questions were asked in the form “Do you think product x is wider/higher than reference y?”

Goal of the survey: evaluate the impact of CompareDimensions on users' ability to correctly evaluate the real dimensions of a product.
Survey results and statistical significance

- 17.5% increment of the number of correct answers.
- From 14% up to 57% increment grouping by product category.

Statistical significance:
- We compared the average user accuracy without and with the aid of the tool using a one-tailed t-test on paired data.
- The increase in average accuracy related to the use of CompareDimensions is significant for $p < 0.01$.
Focus on critical products (1/2)

- Customer reviews were used for classifying products:
  - **Smaller** or **bigger**, if customers complain that product dimensions do not conform to the description provided by the retailer (i.e., critical products).
  - **Unknown**, if no complaint reviews have been extracted for that product.

- Keywords: small, short, tight, big, wide, and large

- Classification patterns:
  - too, very, extra, super + keyword
  - smaller/bigger/. . . than expected
  - not small/short/big/. . . enough.

<table>
<thead>
<tr>
<th>Comment</th>
<th>Class label</th>
</tr>
</thead>
<tbody>
<tr>
<td>Returned. Too big</td>
<td>bigger</td>
</tr>
<tr>
<td>Item is far too large.</td>
<td>bigger</td>
</tr>
<tr>
<td>The base is too wide to fit in a smallish space.</td>
<td>bigger</td>
</tr>
<tr>
<td>Too small, sent it back.</td>
<td>smaller</td>
</tr>
<tr>
<td>The lampshade is super short! Not as pictured.</td>
<td>smaller</td>
</tr>
<tr>
<td>Was too small returned item.</td>
<td>smaller</td>
</tr>
</tbody>
</table>

An example of negative comments along with the label of the related product (Amazon.com)

- We produced a dataset openly available at [https://github.com/SCAlabUnical/CompareDimensions/](https://github.com/SCAlabUnical/CompareDimensions/).
Average accuracy increased by 24%
Per-class improvement:
- **smaller**: 27%
- **bigger**: 11%

Tendency of customers to overestimate product dimensions.
- Images are provided without a scale and smaller products are often zoomed to make the details more visible and clear.
We proposed **CompareDimensions**, a tool designed to help customers during their online purchases.

It allows customers to correctly estimate the dimensions of a product, reducing the likelihood of a return.

Its effectiveness was evaluated using Amazon as a test case, achieving very promising results.

**Future work and possible improvements:**

- Support for 3D images (rotation, translation)
- Improvement of the image processing algorithm
Thank you!