

A visual tool for reducing returns in e-commerce platforms

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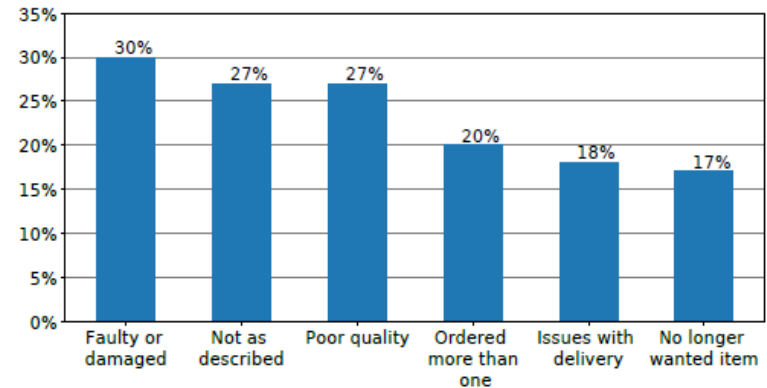
Motivations and goals (1/3)

- 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



The problem of returns (2/3)

- 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.



Motivations and goals (3/3)


- **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

 4 options from \$149.99

 5 options from \$159.99

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

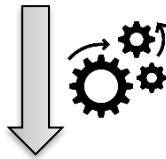
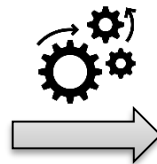
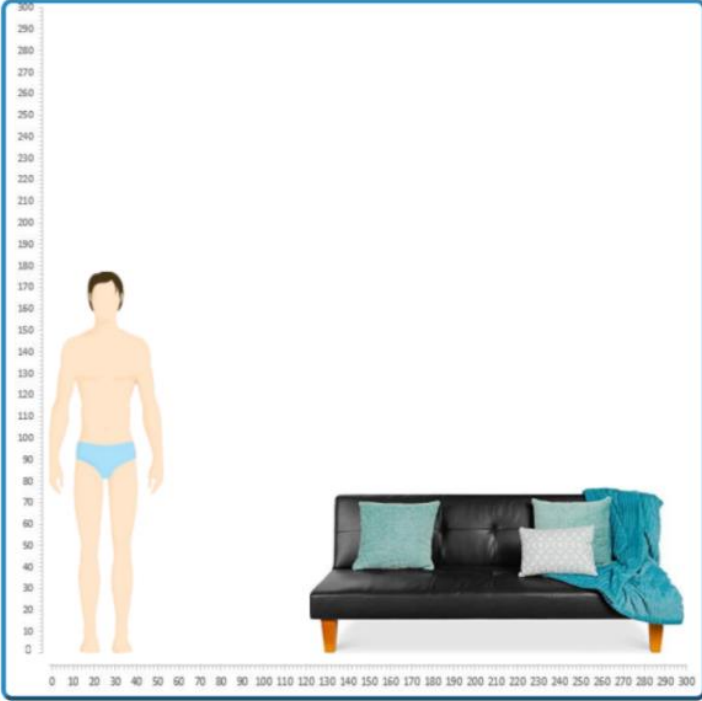


Image collection & processing



Product visualization & comparison

CompareDimensions



Product size



Length	175.26 cm
Width	83.82 cm
Height	76.20 cm

☒ Show reference systems

☐ Show measurements in inches

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.

 4 options from \$149.99	 5 options from \$159.99
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Item Dimensions	LxWxH 69 x 33 x 30 inches
Assembly Required	Yes

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

E-commerce	Total products	Hit rate
Amazon	100	97%
eBay	100	95%
Alibaba	100	94%

Dimensions extraction for different e-commerce sites

- 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.

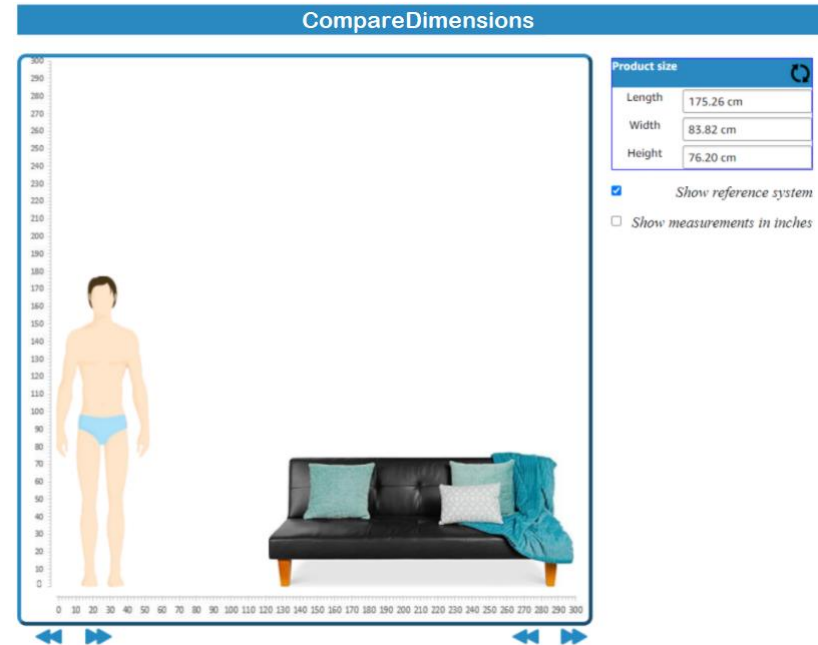
Image collection & processing

- 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.



Name	Height (cm)	Length (cm)
man	175	54
woman	165	45
teenager	150	40
child	100	32
newborn	50	50
school chair	95	50
kitchen chair	82	40
door	210	80

Main references for product comparison

Experimental evaluation

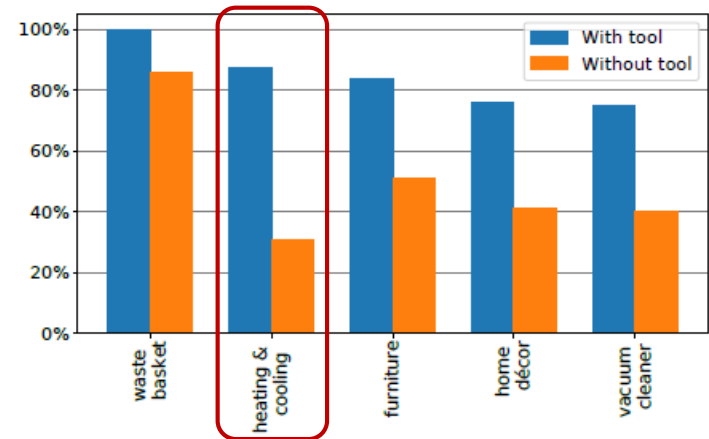
- The effectiveness of the proposed tool was assessed using Amazon as a testbed.
- We implemented the proposed tool as a Google Chrome extension, available at <https://github.com/SCAlabUnical/CompareDimensions>.
- Experimental evaluation was carried out through the administration of a survey.
 - A set 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



Average accuracy of dimension assessment based on the answers of the surveyed users



Average accuracy per product category (top-5)

- 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 $p < 0.01$

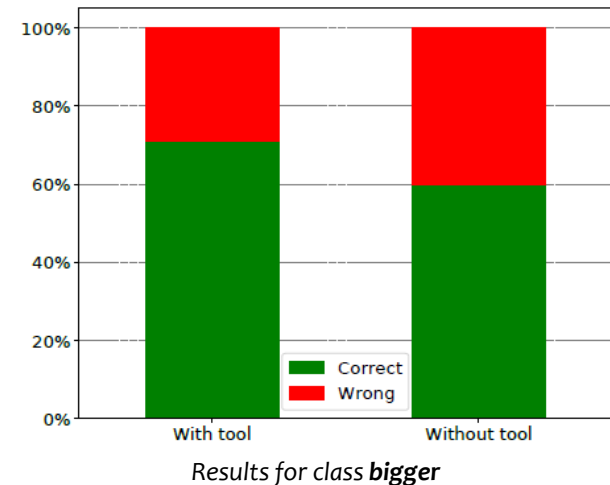
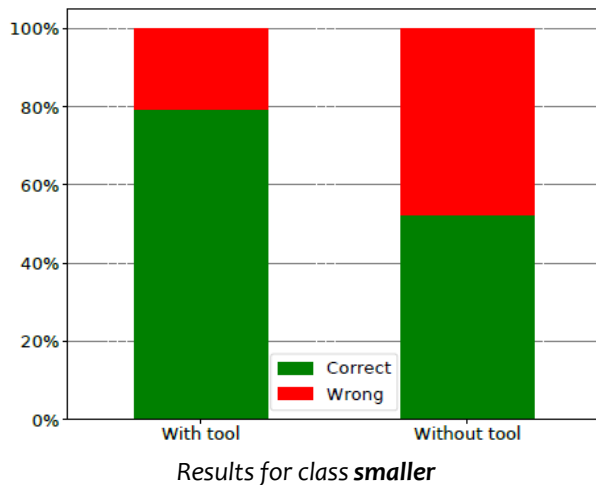
Focus on critical products (1/2)

- 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.
- We produced a dataset openly available at <https://github.com/SCAlabUnical/CompareDimensions/>.

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

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

Focus on critical products (2/2)



- 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.

Conclusions and final remarks

- 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!