Supplementary file: AverageExplorer: Interactive Exploration and Alignment of Visual Data Collections

In this supplementary document, we present additional results that we could not fit in the main paper. Please refer to the corresponding sections in the main paper for discussions and analyses.

Interactive exploration and alignment: Figures 1-4 show the average images and top retrieved images found by our system, k-means clustering, spectral clustering [3], and the recent discriminative sub-category discovery algorithm of [1] on *Kids with Santa*, *Wedding kiss*, LFW, and *Church*, respectively.

User preference study: We conducted a user preference study to compare our average images against those produced by several baselines: (1) ArtistAverage: created by Jason Salavon (Figure 1a in paper); (2) ManualAverage: created by manually selecting images from a database; (3) ClusteringAverage: created by [1]. All methods use $\sim$100 images to generate an average image. We asked 100 Amazon Mechanical Turkers to compare the average images of the methods and select the one that conveys the most information, i.e., clearly depicts a single concept related to the keyword used to create the database (e.g., *'Kids with Santa'*).

For *'Kids with Santa'*, Jason Salavon created only one average image [2], so we select the average image that is most visually similar to his result for all methods. 96, 3, and 1 MTurkers selected AverageExplorer, ArtistAverage, and ManualAverage, respectively. We also performed the same study for 'Faces in the Wild', *'Wedding kiss'* and 'Church', and compared against ClusteringAverage. This time, we compared sets of 6 average images (as shown in Figures 2-4). 99% of MTurkers believed our averages to convey more information about the keyword.

Figures 5 and 6 show an example Mechanical Turk HIT for the user preference study. We only allowed MTurkers who have completed at least 1000 jobs and have an approval rating ≥ 95 to work on our HIT.

Visual data representation user study: Figures 10-13 show an example Mechanical Turk HIT for the visual data representation user study. We only allowed MTurkers who have completed at least 1000 jobs and have an approval rating ≥ 95 to work on our HIT.

User experience study: We show all of the user-generated averages in Figures 7- 9. For the difficult queries, the users were unable to create an average image that corresponded to the text description. The resulting average images were distorted, blurry, or irrelevant to the text description despite the users spending more time to create them.

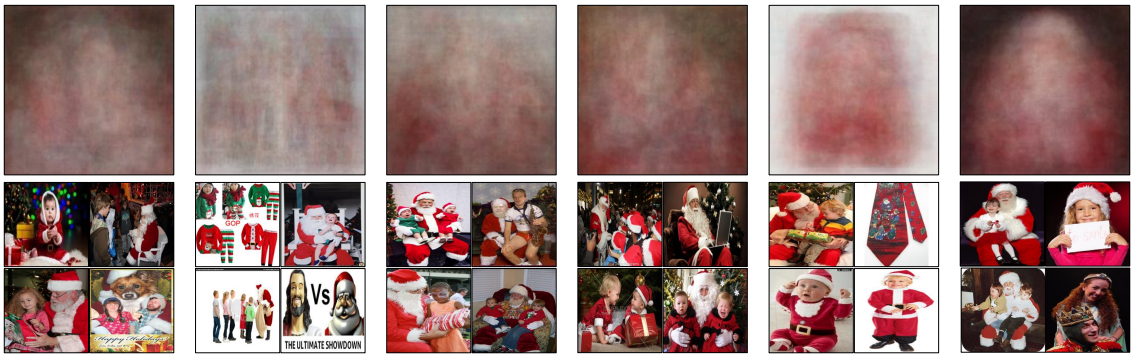
References

[1] M. Hoai and A. Zisserman. Discriminative Sub-categorization. In *CVPR*, 2013.

[2] J. Salavon. www.salavon.com/work/specialmoments/, 2004.

[3] J. Shi and J. Malik. Normalized Cuts and Image Segmentation. *TPAMI*, 2000.

(a) Ours

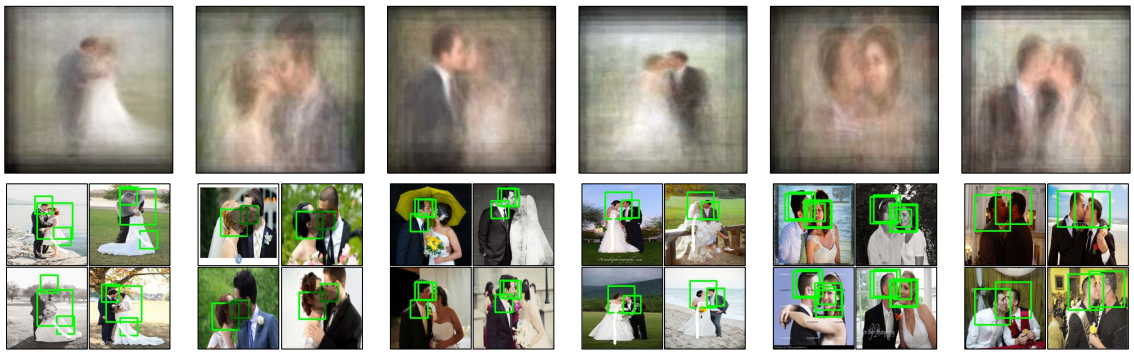


(b) [Hoai and Zisserman, 2013]

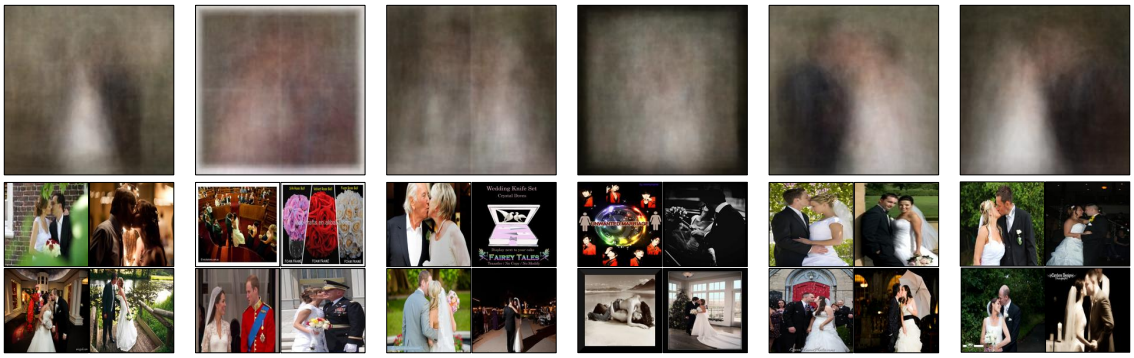
(c) k-means

(d) Spectral clustering

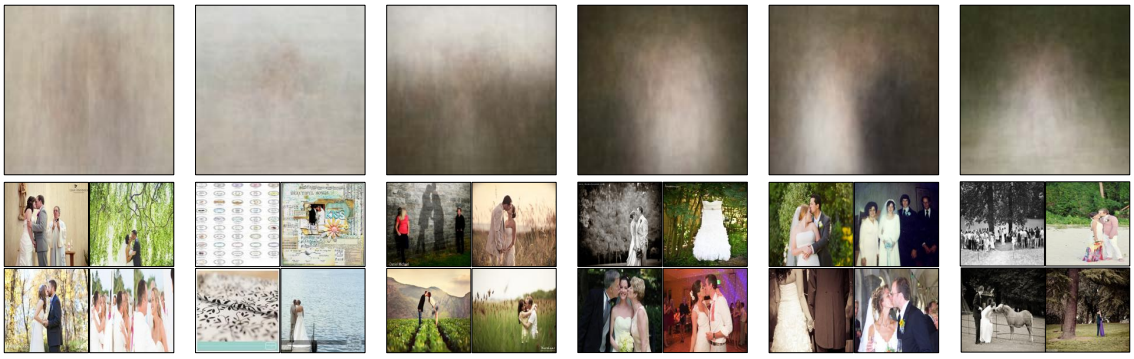
Figure 1. Kids with Santa.



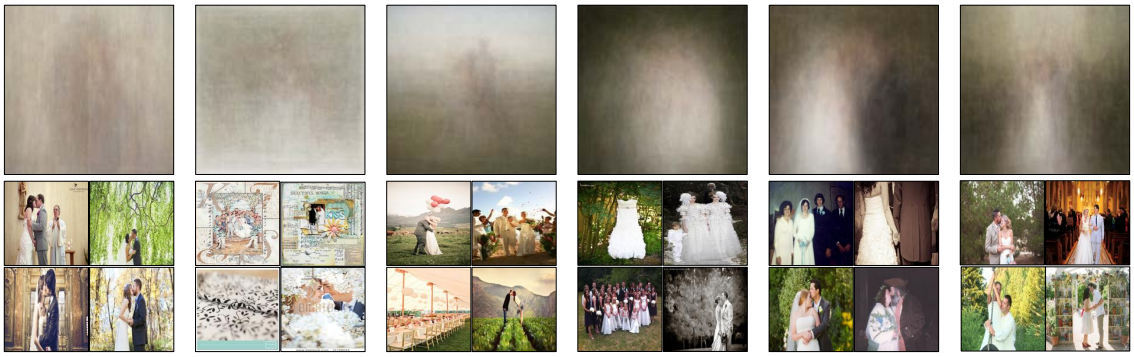
(a) Ours



(b) [Hoai and Zisserman, 2013]

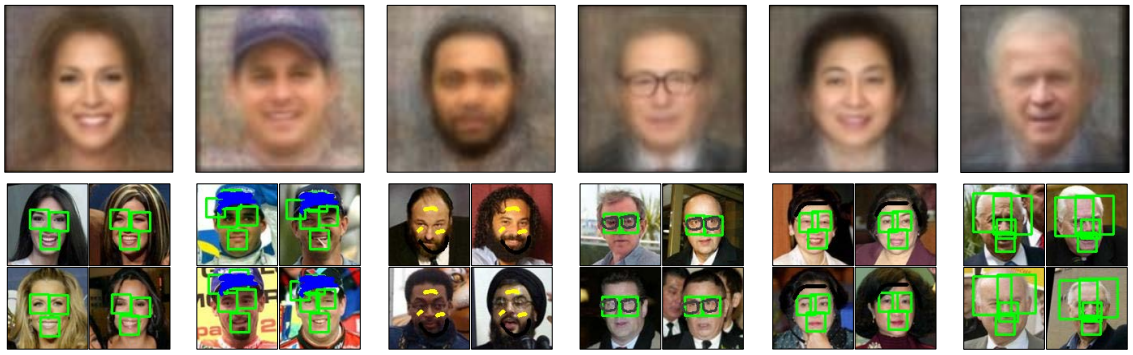


(c) k-means



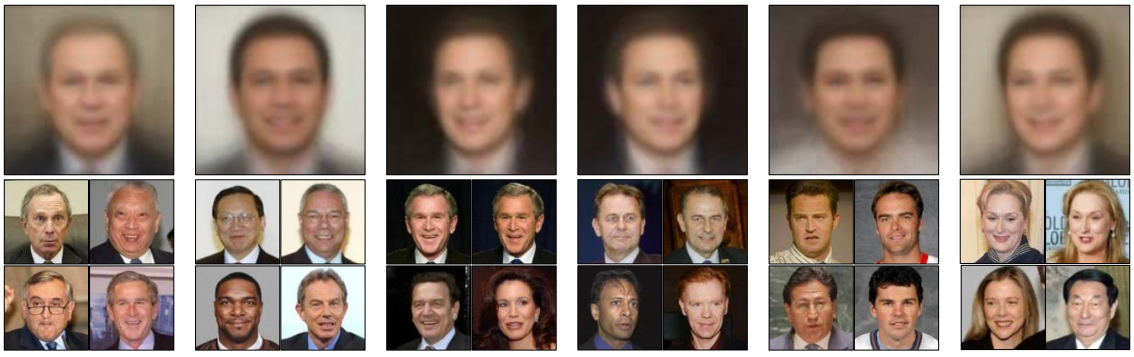
(d) Spectral clustering

Figure 2. Wedding kiss.

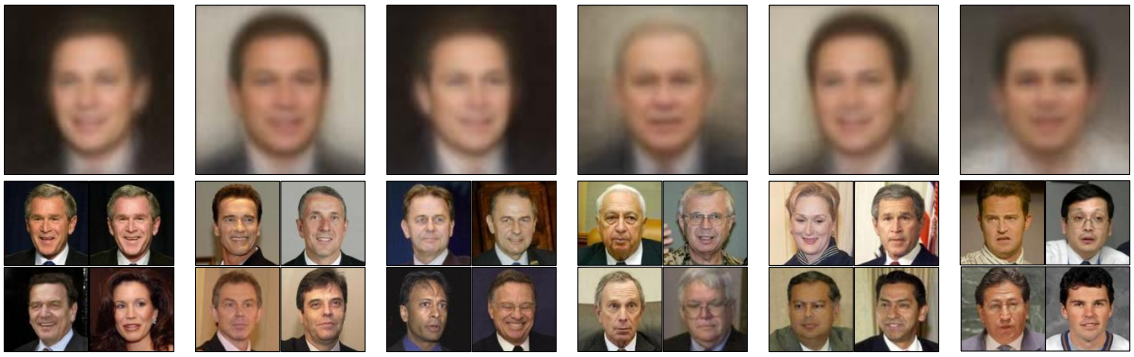


(a) Ours

(b) [Hoai and Zisserman, 2013]

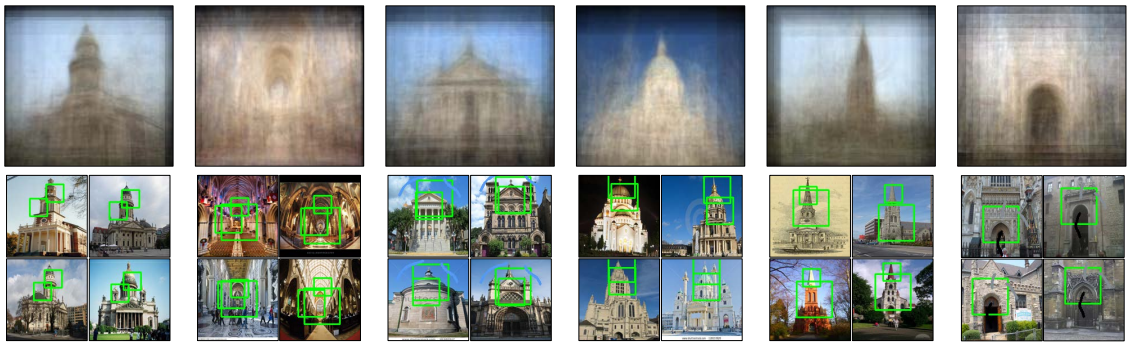


(c) k-means

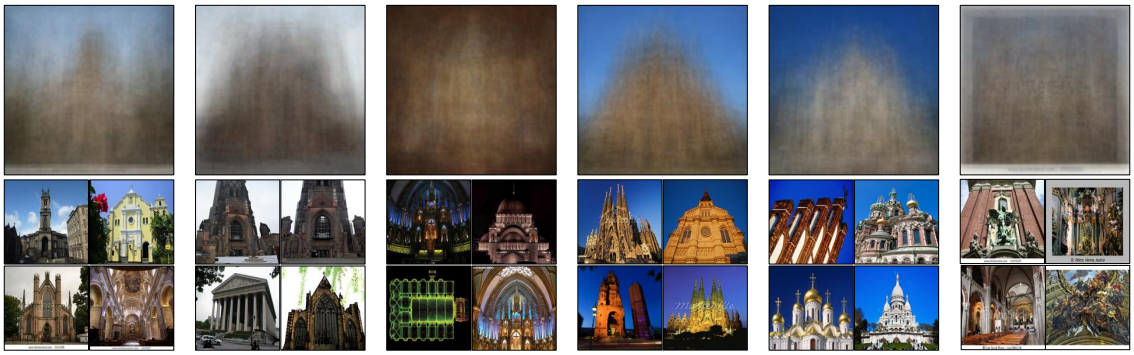


(d) Spectral clustering

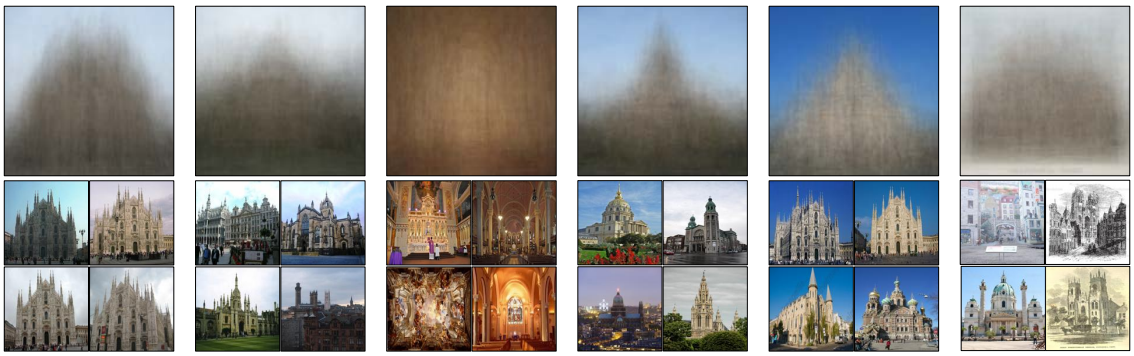
Figure 3. Labeled Faces in the Wild.



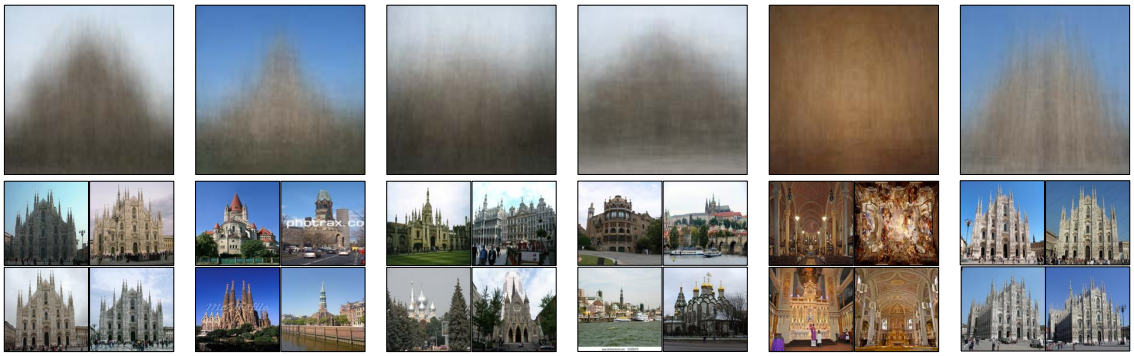
(a) Ours



(b) [Hoai and Zisserman, 2013]



(c) k-means



(d) Spectral clustering

Figure 4. Church.

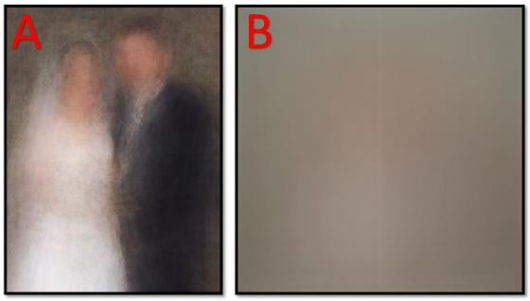
User Preference Study HIT: Which group of images conveys more information about "kids with santa"?

Instructions

- Given 5 groups of images, your task is to select the group that conveys more information about **"kids with santa"** than the other groups does. In your selected group, each image should clearly depict a single concept related to "kids with santa" so that one can easily understand the meaning of the image. Each group may contain 1 to 6 images.
- Before you start, first take a look at the following two examples for reference.
- **[Attention]** One can only accept **ONE** HIT for the same Category ID. **(kids with santa)**

Examples

Example 01



In Example 01, Image A conveys more information than Image B does. Image B looks too blurry while in Image B, one can clearly guess that there is a newlywed couple. You should select the group that contains Image A.

Example 02

In Example 02, Image A conveys more information than Image B does. Image B mixes up different meanings; however, Image A clearly depicts a single concept (i.e. newlywed.) You should select the group that contains Image A.

Figure 5. Example HIT for User Preference Study (Part I)

Test

Please select one from the following 5 groups.

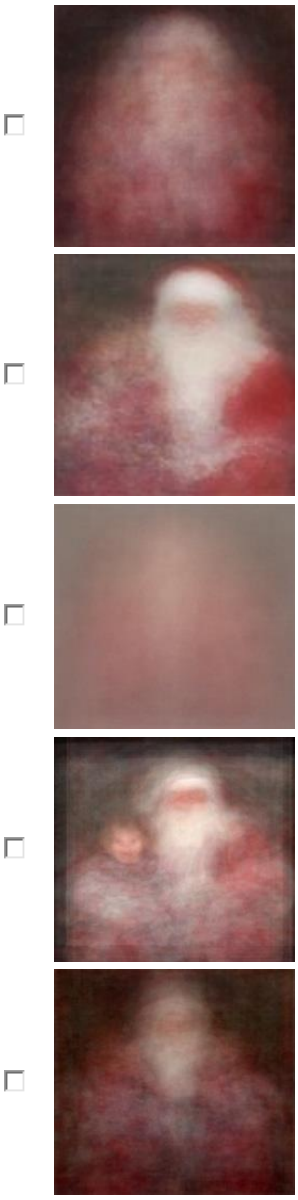


Figure 6. Example HIT for User Preference Study (Part II)

Figure 7. *"Kids with Santa"* averages created by users given a text query. The last column show failure cases. The users produced blurry and distorted averages for difficult queries that have insufficient data

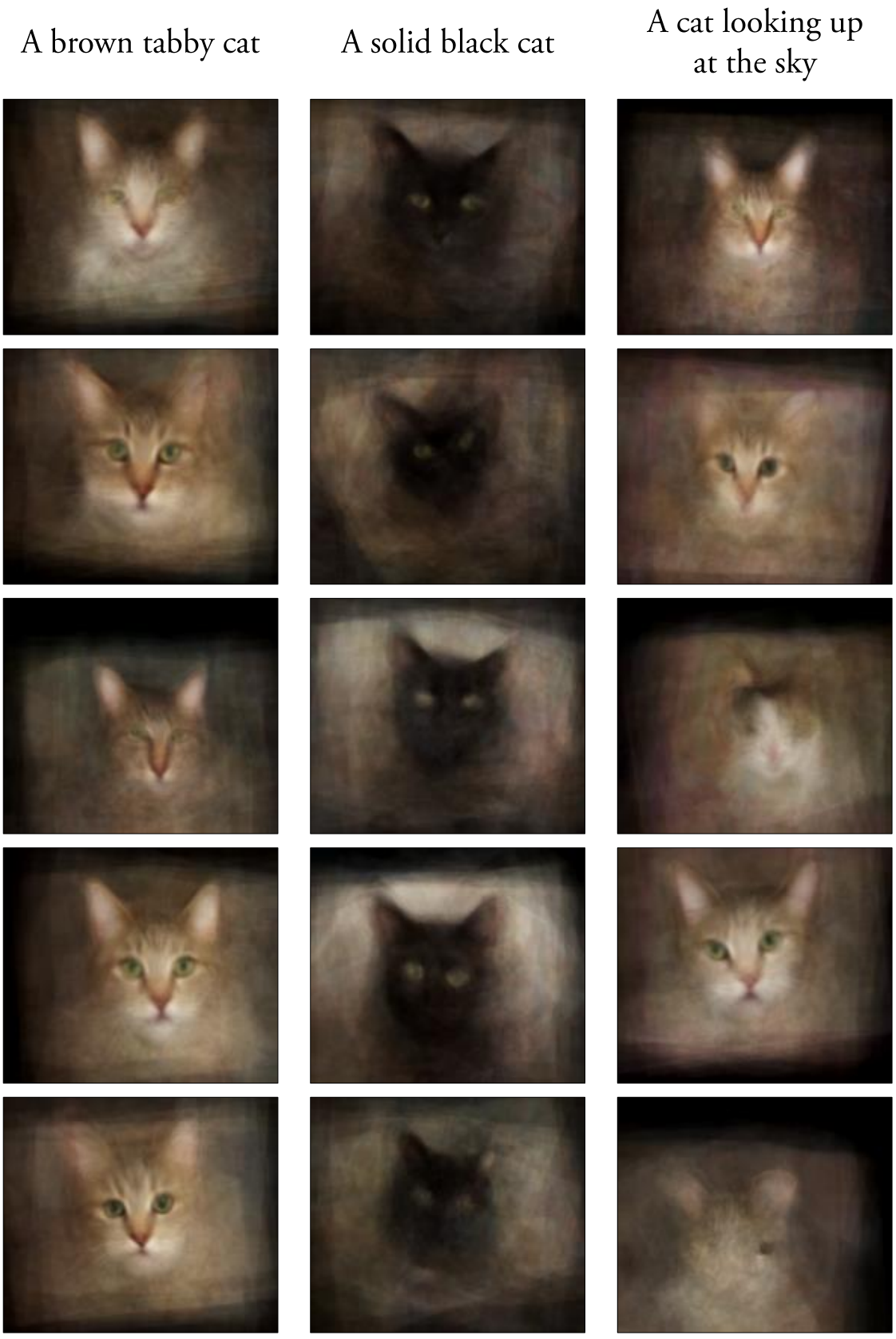


Figure 8. *"Cat"* averages created by users given a text query. The last column show failure cases. The users produced blurry and distorted averages for difficult queries that have insufficient data

Figure 9. *"Horse"* averages created by users given a text query. The last column show failure cases. The users produced blurry and distorted averages for difficult queries that have insufficient data

Example HIT for Visual Representation User Study

Select 15 images belonging to the concept

Concept ID: [concept2]

Instructions

1. Carefully observe the **12 representative images** at the top. Collectively, they represent a concept, such as "cat" or "wedding kiss". Note that each representative image could be an average of several images.

2. There are **30** test images below the representative images. Select **15** images that are also likely to represent the same concept as the representative images. For example, if you think the representative images represent "cat", then select **15** "cat" images.

[Spam Question] Note that we purposely include THREE images that also appears among the representative images. If you fail to select these images, your submission will be REJECTED and we will BLOCK you from completing any further tasks of this HIT.

[Attention] You can only accept ONE HIT for each concept. (Please refer to the concept ID [concept2]). If you finish more than ONE HIT, the extra work will be REJECTED and we will BLOCK you from completing any further tasks of this HIT.

Representative Images of the concept

Figure 10. Example HIT for Visual Data Representation User Study (Part I)

Figure 11. Example HIT for Visual Data Representation User Study (Part II)

Figure 12. Example HIT for Visual Data Representation User Study (Part III)

Figure 13. Example HIT for Visual Data Representation User Study (Part IV)