

Auditing saliency cropping algorithms:Supplementary

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1. Supplementary to the Introduction section in the main paper

Context: "Saliency-based Image Cropping (SIC) is currently used to algorithmically crop user-uploaded images on most major digital technology and social media platforms, including Twitter [7, 8, 11], Adobe [1, 6], Google (via the `CROP_HINTS` API) [3], Microsoft (via the `generateThumbnail` and `areaOfInterest` APIs) [5], Filestack [9] and Apple [2, 4]. (See the supplementary material for real-world examples from Facebook and Google.)"

1.1. Real-world examples from Facebook and Google

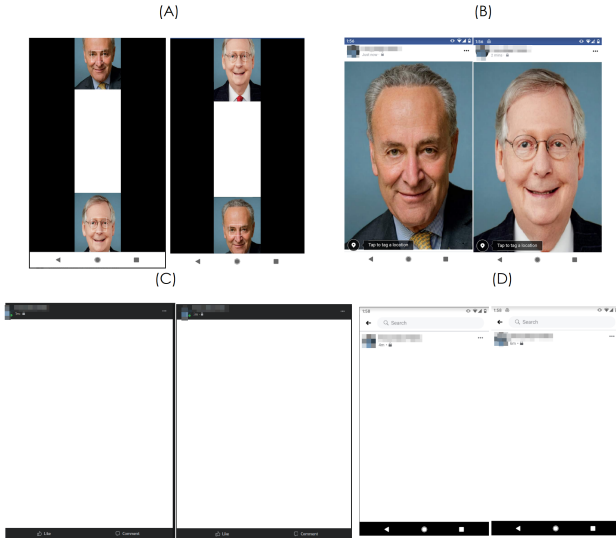


Figure 1: Gallery of images demonstrating the effect of SIC on Facebook across various modalities of access

As stated in the introduction section, SIC is not a platform-specific issue that impacts Twitter alone. The SIC algorithmic pipeline today permeates other platforms that

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bank on voracity of consumption of news and social media content that might entail digital images. In this section of the supplementary paper, we present specific examples from two other high-data-volume, high-data-velocity platforms, specifically Facebook and Google-Feed¹.

Firstly, in Figure 1, we present the vagaries observed in the SIC cropping results on Facebook upon changing the modality of consumption from mobile to desktop and depending on whether we were accessing the platform via the official mobile app or a browser. In sub-figure 1(A), we see the screenshots of the two input longitudinal 3×1 grid images² with their face-detection bounding boxes produced by Facebook. In sub-figure (B), we present the post-cropped image screenshots of the input images when the mode-of-access was via a the Chrome web-browser (version 90.0.4430.210) on an Android 11 | Pixel 2 device. As seen, the bottom-face in the input-image-grid is cropped out on both the instances. Sub-figures 1(C) and 1(D) present the post-cropped images that center-cropped focusing on the middle-blank white space of the 3×1 input image grid when the mode of access was via the desktop-version Version (Chrome 90.0.4430.212 - Official Build and 64-bit Windows 10.0.1.19041) and the Facebook mobile app (Android - version 319.0.0.39.120).

In figure 2, we present screenshots of images procured while using *Google Feed* [10]. In figure 2 the left sub-figure(s) captures the cropped image as seen in the Google Feed App (Snapshot on the same mobile test device as the previous section running Android - version 319.0.0.39.120) and the right sub-figure shows the original image hosted on the web-page associated with the link in the feed that was ostensibly cropped before appearing on the feed. As seen in figure 2(B), we observe another intriguing example of people's images getting cropped out in the case of *long rectangular input images* much akin to what unravelled on Twitter. Except, in this case, it was not a

¹<https://www.blog.google/products/search/feed-your-need-know/>

²Images of US politicians Charles (Chuck) Schumer (left) and Mitch McConnell(right in sub-figure 1(B))

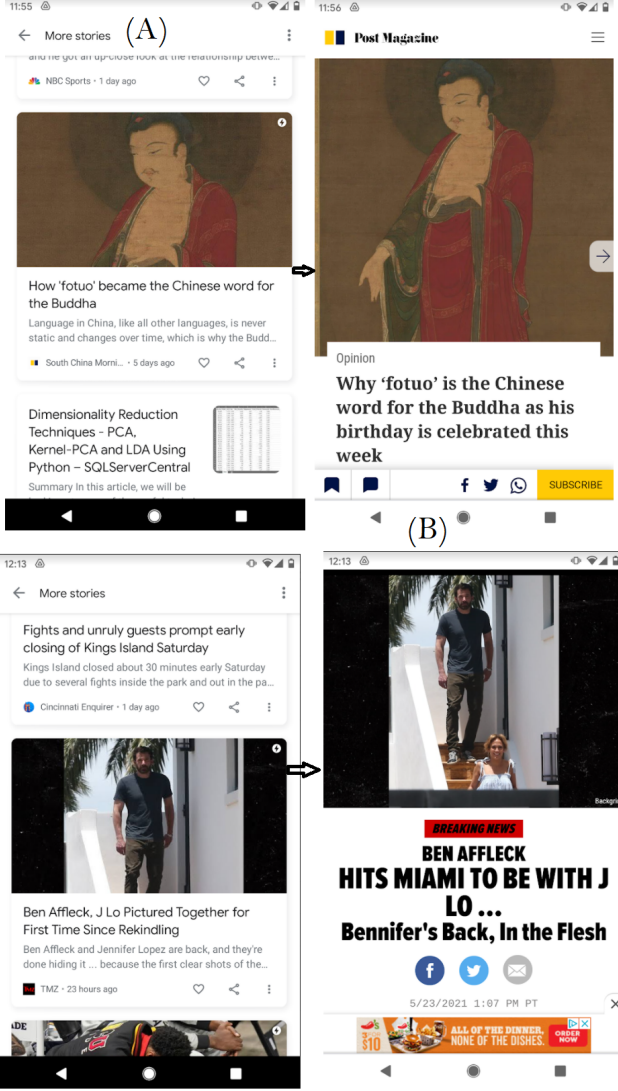


Figure 2: Examples of SIC via Google feed screenshot from the authors' personal Android device

synthetically generated 3×1 image grid to blame but a naturally occurring image with *J Lo*'s image getting cropped out and *Ben*'s image *surviving* the crop.

2. Supplementary to the Dataset curation section in the main paper

Context: "This, we believe, would not only allow us to supplement and compare the results from [11] but also allow us to side-step indulging in customized mappings of race and ethnicity used in the study. (See Table 1 in the supplementary material.)"

wikidata-code	race	ethnicity
Q190168	black	Yoruba people: ethnic group of West Africa
Q49085	black	African Americans
Q127885	white	Serbs: nation and South Slavic ethnic group
Q42406	white	English people: nation and ethnic group
Q44806	white	Ukrainians: East Slavic ethnic group
Q539051	white	Greeks: people of southeastern Europe
Q678551	white	American Jews
Q726673	white	Swedish-speaking population of Finland
Q7325	white	Jewish
Q79797	white	Armenians: ethnic group native to the Armenia
Q179248	white	Albanians
Q2325516	white	Armenian American

Table 1: The mapping of ethnicity and race in [11]. (Sourced from <https://bit.ly/3z0XuPc>.)

3. Supplementary to the Experiment and results section in the main paper

Context: The 'middle-white-space cropping'

In Figure 3, we present example images covering such occurrence across the six combinations considered. It is to be noted that we observed the same effect in our initial study on Facebook as well (See the supplementary section for a collage of examples).

In figure 4, we present the collage of real-world examples that suffered from the middle-white-space cropping phenomenon. The left sub-figure contains the post-cropping images as viewed in a desktop setting³ and the right sub-figure contains the actual input images (organized in a clockwise fashion and including the vertical-flipped versions of the images).

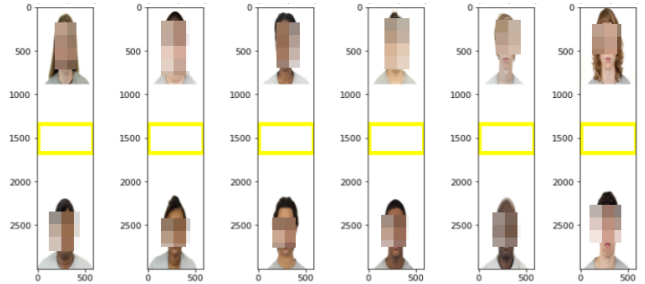


Figure 3: Examples where neither face could *survive* the cropping with Google's CROP_HINTS framework.

References

- [1] Adobe. Adobe research » search results » cropping. <https://research.adobe.com/?s=cropping&researcharea=&contenttype=>

³See Figure 1 that presents the possible variations across viewing devices

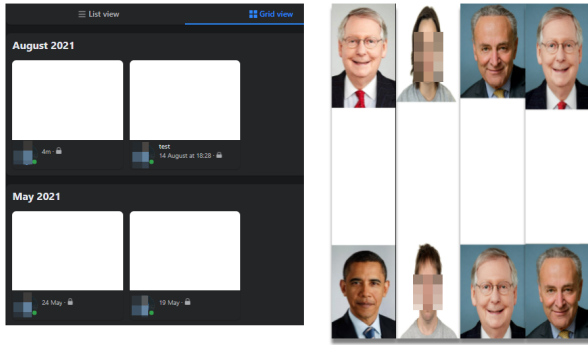


Figure 4: Real-world examples where neither face could survive the cropping with Facebook’s SIC framework.

- &searchsort=, December 2020. (Accessed on 12/05/2020).
- [2] Apple Developer Documentation. Cropping images using saliency. https://developer.apple.com/documentation/vision/cropping_images_using_saliency, June 2019. (Accessed on 08/17/2021).
 - [3] Google Cloud documentation. Detect crop hints | Cloud Vision api . <https://cloud.google.com/vision/docs/detecting-crop-hints>, Apr 2019. (Accessed on 08/18/2021).
 - [4] Brittany Weinert et al. Understanding images in vision framework | WWDC19. <https://apple.co/37VsIeE>, June 2019. (Accessed on 08/17/2021).
 - [5] Patrick Farley et al. Generating smart-cropped thumbnails with computer vision. <https://docs.microsoft.com/en-us/azure/cognitive-services/computer-vision/concept-generating-thumbnails>, May 2020. (Accessed on 08/18/2021).
 - [6] Lauren Friedman. ICYMI: Adobe summit sneaks 2019. <https://blog.adobe.com/en/2019/03/28/icymi-adobe-summit-sneaks-2019.html#gs.9a62ez>, March 2019. (Accessed on 08/18/2021).
 - [7] Alex Hern. Twitter apologises for ‘racist’ image-cropping algorithm | Twitter | The Guardian. <https://www.theguardian.com/technology/2020/sep/21/twitter-apologises-for-racist-image-cropping-algorithm>, Sep 2020. (Accessed on 10/20/2020).
 - [8] Zehan Wang Lucas Theis. Speedy neural networks for smart auto-cropping of images. https://blog.twitter.com/engineering/en_us/topics/infrastructure/2018/Smart-Auto-Cropping-of-Images.html, January 2018. (Accessed on 10/19/2020).
 - [9] Tomek Roszczynialski. Smart image cropping using saliency • Filestack blog. <https://blog.filestack.com/thoughts-and-knowledge/smart-image-cropping-using-saliency/>, August 2020. (Accessed on 10/19/2020).

- [10] Shashi Thakur. Google feed: feed your need to know. <https://www.blog.google/products/search/feed-your-need-know/>, July 2017. (Accessed on 05/24/2021).
- [11] Kyra Yee, Uthaipon Tantipongpipat, and Shubhanshu Mishra. Image cropping on Twitter: Fairness metrics, their limitations, and the importance of representation, design, and agency. *arXiv preprint arXiv:2105.08667*, 2021.