Vape Detector using Computer Vision

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Introduction

- Social media has enabled rapid spread of e-cigarette content. TikTok is an important example.
- There remains a dearth of studies specifically exploring the image content in the videos in TikTok posts.
- We seek to address this gap by quantifying the prevalence of TikTok videos that contain a vape or a person vaping.

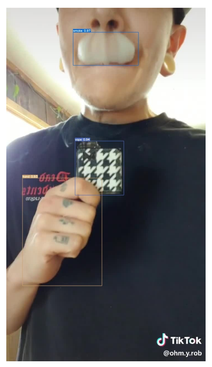
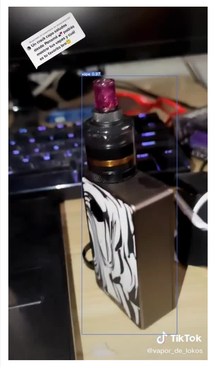
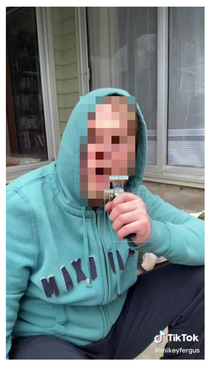
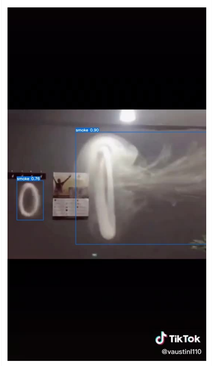
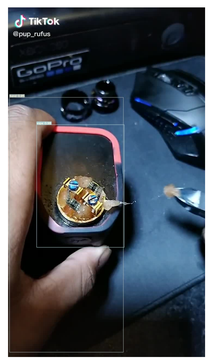
Methods

- We scraped TikTok's website for videos that contain #vape, #vapestagram, #vapor, #vapecommunity, and #vapenation in their caption
- We labelled "vape", "smoke", and "hand" classes In 884 images from 254 distinct posts, with an 85:15 train:test split (i.e., 755 images for training and 129 for testing).
- We used transfer learning with YOLOv7 object detection algorithm for our research.

Results

- Our model locates a vape, hand, and smoke in an image, with an F1 score of 0.81 on the test set.
- Our model has a recall value of 0.771 on all classes.
- This means that it locates approximately 771 videos out of 1000 on average that contain vape-related products and vaping behaviors.

Image Categories and Model Results

Person smoking a vape	Side view of a vape	Person smoking a barely visible vape*	Smoke rings	Top view of a vape
				
Vape (94%), smoke (97%), hand (93%)	Vape (97%)	Vape (91%), hand (91%)	Smoke (76% and 90%)	Vape (94% and 58%)

(%): confidence values
***: pixelated for anonymity**

Statistical Analyses

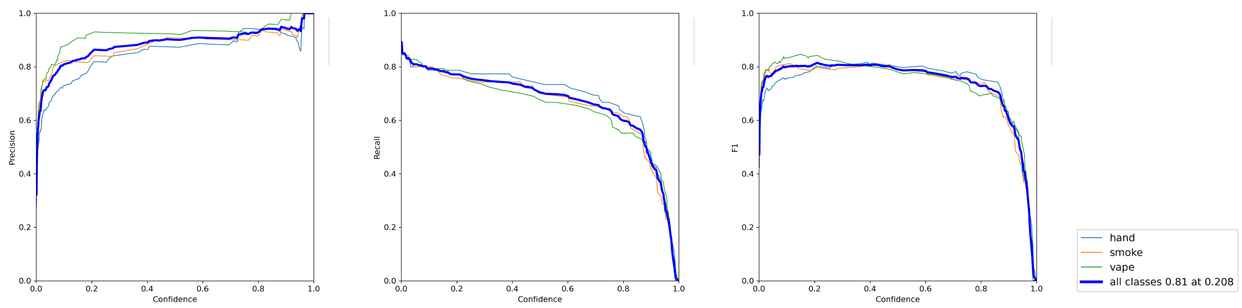


Figure: Precision, Recall and F1 curves over confidence values

Class	Images	Labels	P	R	mAP@.5	mAP@.5:.95:
all	121	232	0.863	0.771	0.82	0.542
hand	121	75	0.819	0.787	0.803	0.554
smoke	121	70	0.841	0.757	0.812	0.495
vape	121	87	0.929	0.77	0.844	0.578

Table: Model results – class wise precision (P), recall (R), mean average precision (mAP)

Conclusion

- Our model detects the location of vapes, smoke, and hands (if any) in an image.
- This model enables quicker detection of e-cigarette-related content which would otherwise be a time and labor-intensive task, if carried out by a human.
- Our method is especially useful in contributing automated and interpretable analyses of video data on a massive scale.

Future Work

- This object detection model can be expanded to detect other e-cigarette related content.
- Analyses of object co-occurrence can give more information about the video. For example, if the vape, hand and smoke are in close proximity, it can be concluded that the person is vaping.
- This model can be used as a means of regulation on other social media platforms such as YouTube, Instagram, etc.

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