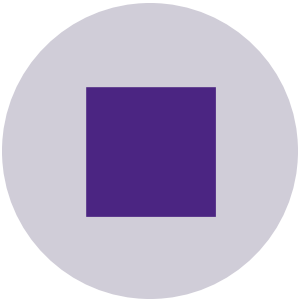
Object-detection for content moderation with xAI

David Pichler
Timo Rodinger

Background and Rationale

DIGITAL SERVICES ACT

SOCIAL MEDIA PLATFORMS



BLACK BOX AND LACK OF TRANSPERANCY

Research question

- Can the implementation of Explainable AI techniques effectively improve content moderation with object detection systems by providing transparent insights into decision-making processes and enhancing moderators‘ ability to assess detection outcomes?
  - *Yes, but…*

    - RQ1.1: Can state of the art ML / DL models effectively be used to help with violent content moderation in social media? - *Yes*
    - RQ1.2: Can these SOTA Models be used together with xAI and Captum? - *Generally yes, but…*
    - RQ1.3: How do different SOTA ML image detection models differ in their explainabilty from each other? Which models are better explainable than others? - *Future Research*

Results

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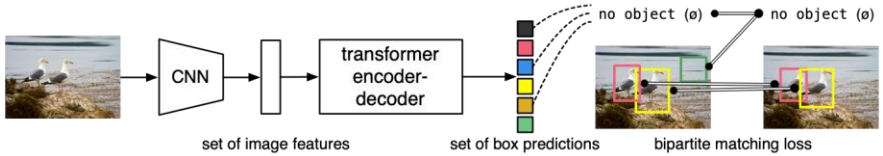
Models & Libraries

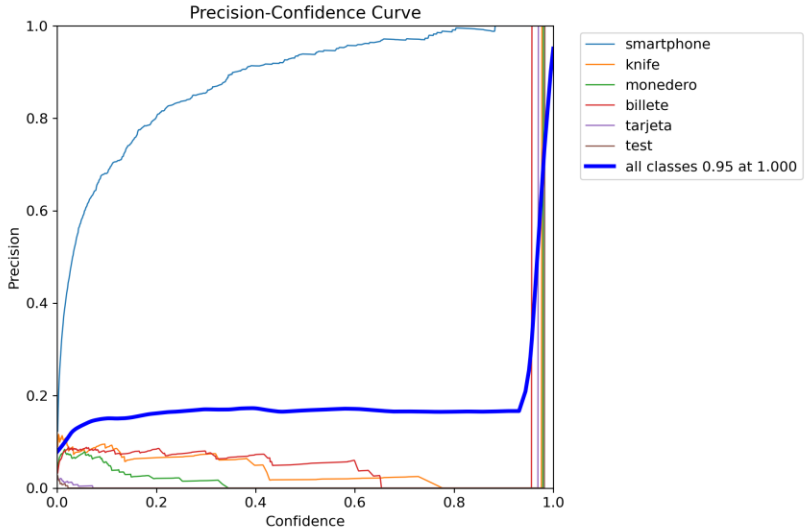
ultralytics
YOLOv8



Captum

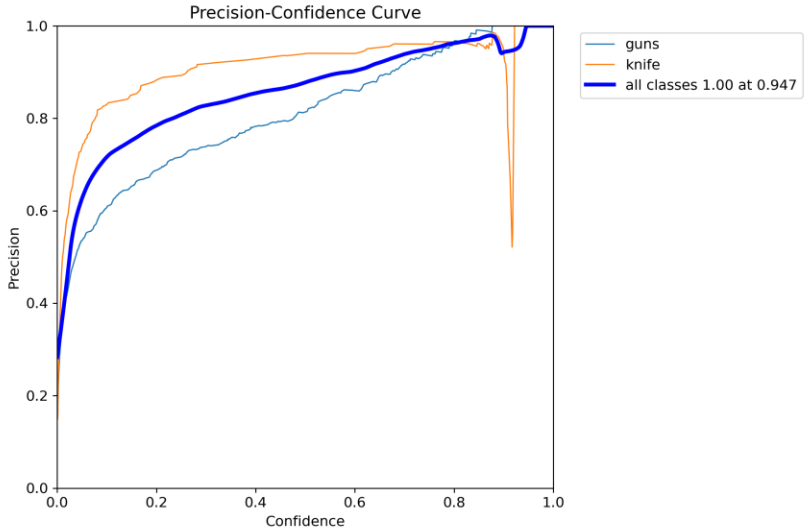
Self-Trained Yolov8

- Dataset based on weapons and similar data
- Good at identifying smartphones
- Bad at every other category
- Overall Precision of 0.2



Pre-Trained model

- Only 2 classes
- Guns and knifes
- Way better performance
- More fitting for our use case



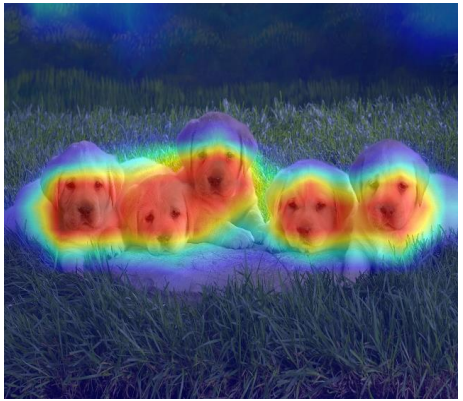
Dataset & Model Classes

- **Sohas_weapon-Detection** *(Our model)*
  - 5000 training images
  - 6 classes
    - Pistol
    - Knife
    - Smartphone
    - Bill
    - Purse
    - Card
- **Weapon 2 Computer Vision Project** *(Pre-Trained Model)*
  - 4098 training images
  - 2 classes
    - Knife
    - Gun

Why does the pre-trained model work better?
Assumption: 6 vs 2 Classes

xAI with Eigen Grad-CAM

- Highlight the most critical features -> PCA
- Visualize the important regions of an input image that contribute to the CNN's output
- Uses PCA to reduce the dimensionality of the gradients, potentially highlighting the most significant features more effectively



Our final result

Standard Model

Our self-trained model

Our final result

Pre-Trained Weapon Model

Eigen Grad-CAM

What would be our next steps…

- Improve object / weapon detection model
  - Test Different Frameworks (e.g. DETR, Yolov10)
  - Better Data
- Compare different explainability techniques
  - Grad-CAM ++
  - Augmented Grad-CAM
- Try it on social media
  - Real-time detection
- Usage in Security Context
  - Real-time security footage monitoring

More Examples

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Hurl

Standard Model

Our model

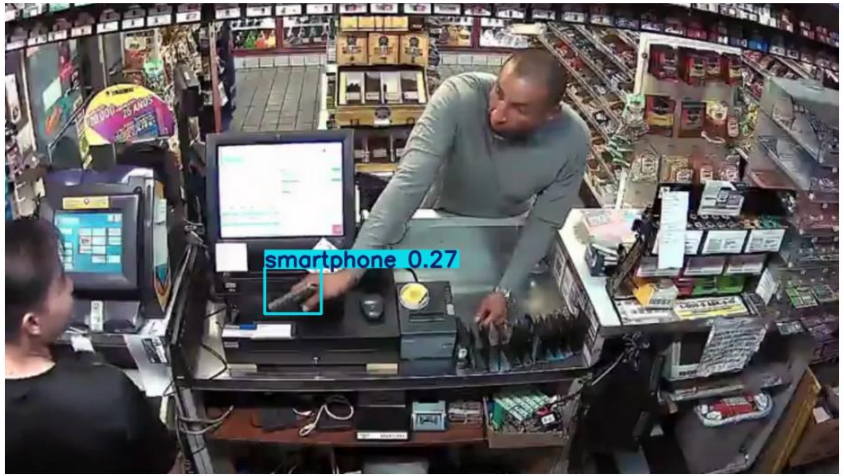
Hurl

Weapon Model

Grad-CAM

Robbery

Standard Model



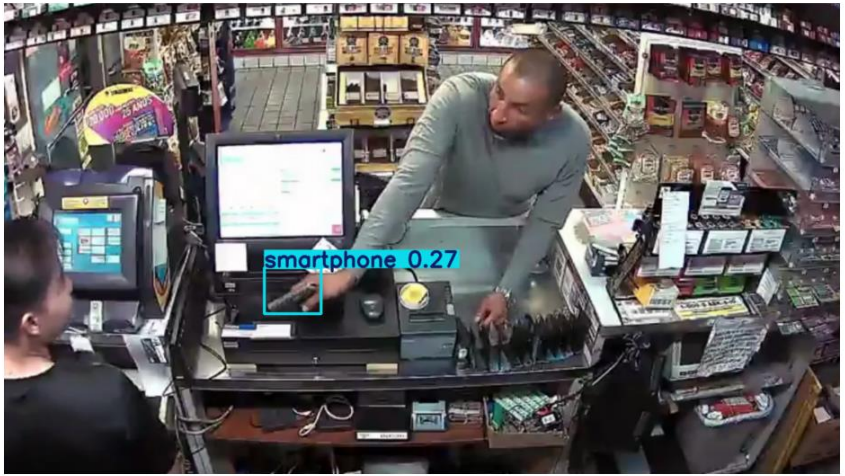
Our model

Robbery

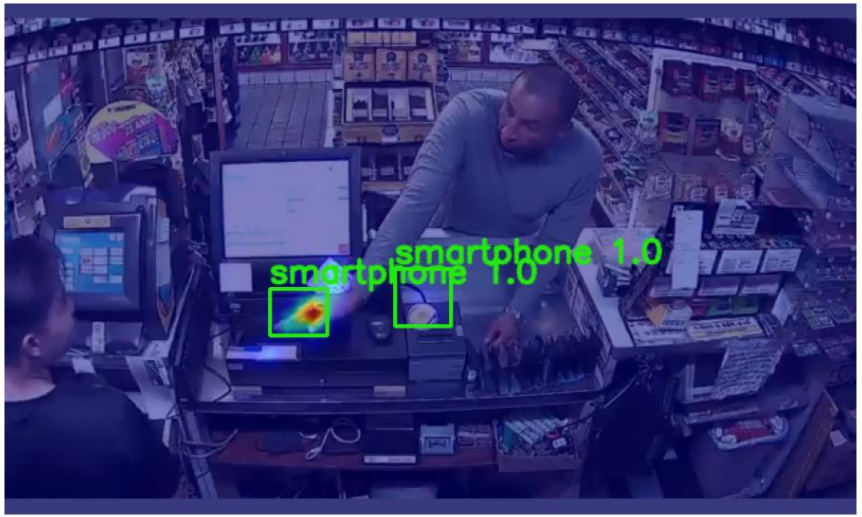
Weapon Model

Grad-CAM

Robbery



Our Model



Our model GradCam

Demo

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