

INTRODUCTION

Problem and Solution

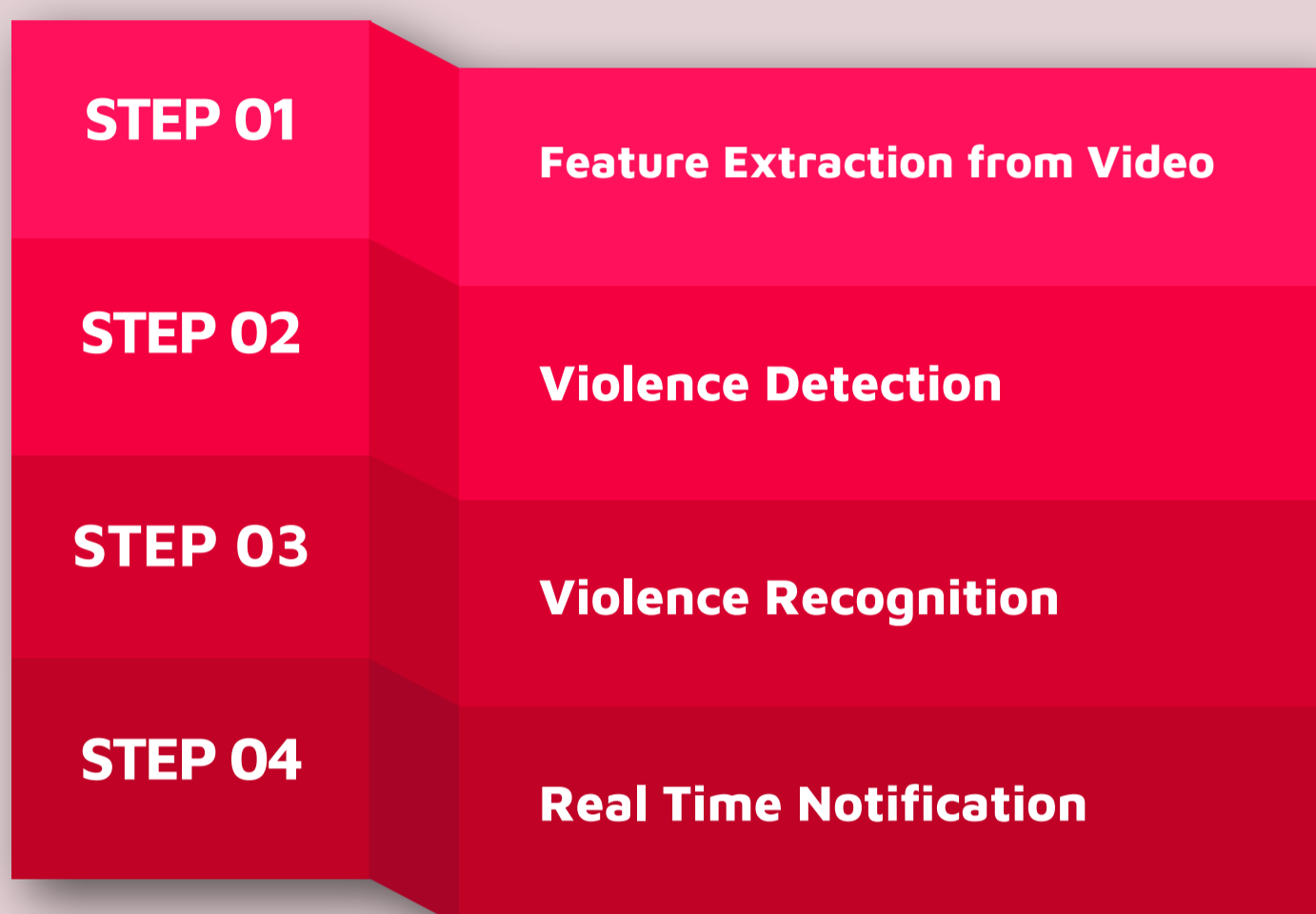
Today's world is surrounded by many surveillance cameras. This indispensable CCTV networks for fight against violence can be very costly due to the manpower it needs.



The aim of this project is decreasing **manpower** and **cost** with **autonomous detection**, **recognition** and **notification**.

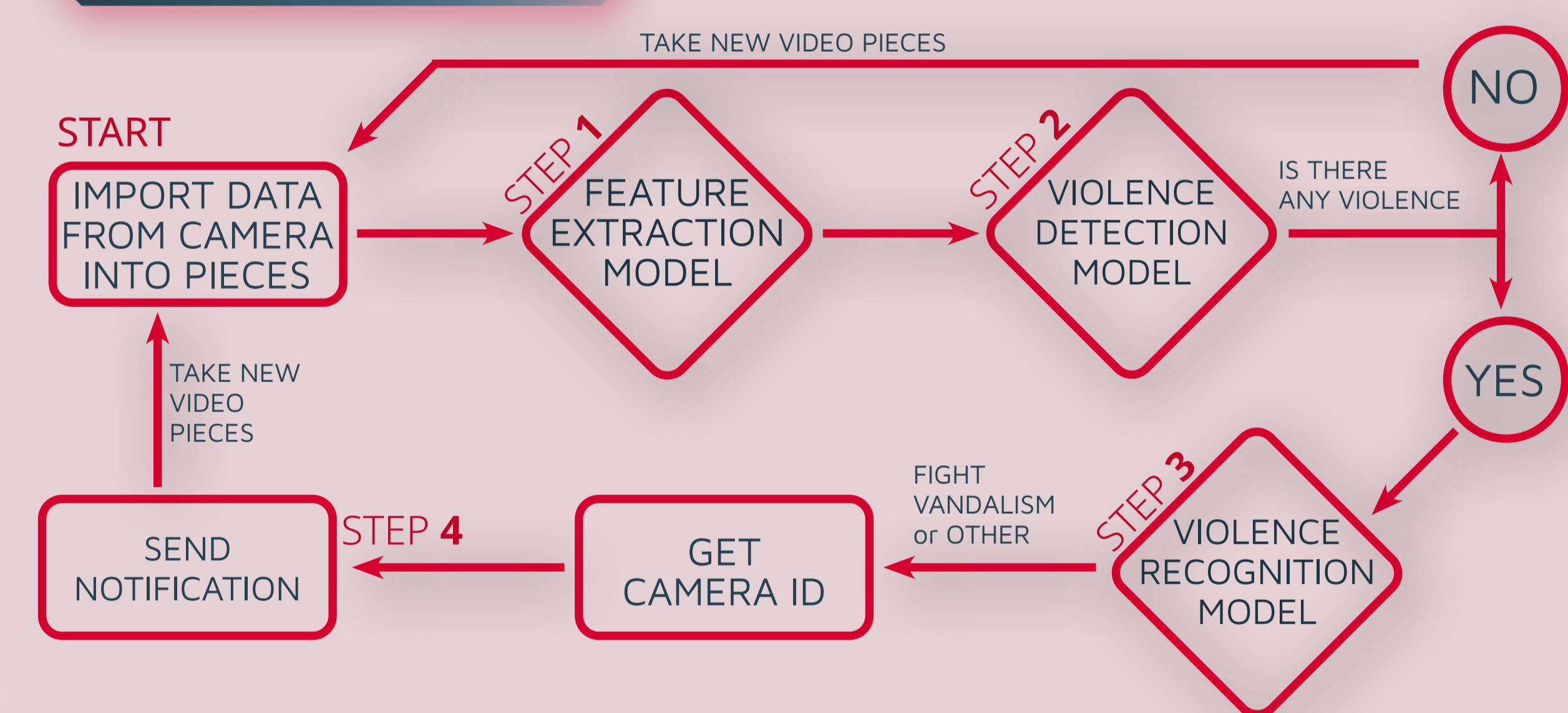
METHODOLOGY

Strategy and System Design



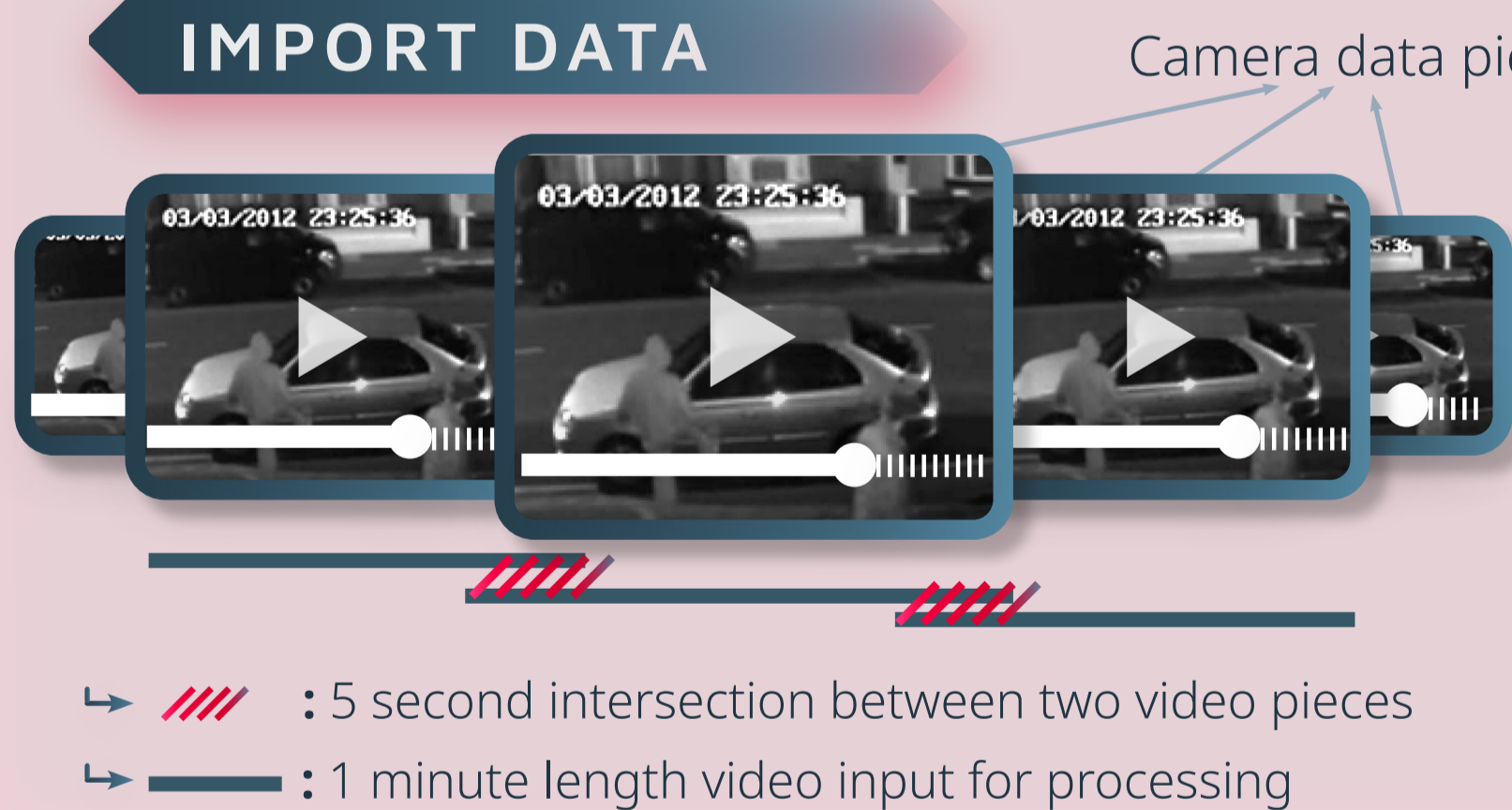
- Feature Extraction:** Converting videos to "txt" files with pretrained C3D model.
- Violence Detection:** Detecting is there a violence or not with using a model.
- Violence Recognition:** If there is violence, to determine whether the type is fight or vandalism with using the third model.
- Notification:** To inform the required units instantly.

FLOWCHART



- This project focused on **real-time** detection.
- To achieve real-time detection aim, the system needs to process **fast** enough.
- The categories to be detected are classified as **fighting** and **vandalism**.
- The **other** types of violence (assault, robbery, shoplifting etc.) are classified as the third category. (maybe helpful for future works with extended scope)

IMPORT DATA



DATA SETS

UCF Crime / NTU CCTV Fight

UCF Crime Dataset (1)

Example Frames

- 1900 videos
- Total 128 hours
- 13 different types
- 7247 average frames

Types

- Abuse
- Arrest
- Arson
- Assault
- Road Accident
- Burglary
- Explosion
- Fighting
- Robbery
- Shooting
- Stealing
- Shoplifting
- Vandalism and non-violent

Fight in custody

Robbery in the market

Explosion

NTU CCTV Fight Dataset (2)

Example Frames

	Videos	Durations (h)
All	1,000	17.68
CCTV	280	8.54
Non-CCTV	720	9.13

Fight in traffic

Fight video recorded by phone camera

Non-CCTV:
Mobile cameras
Car cameras
Drones
Helicopters

TECHNOLOGIES

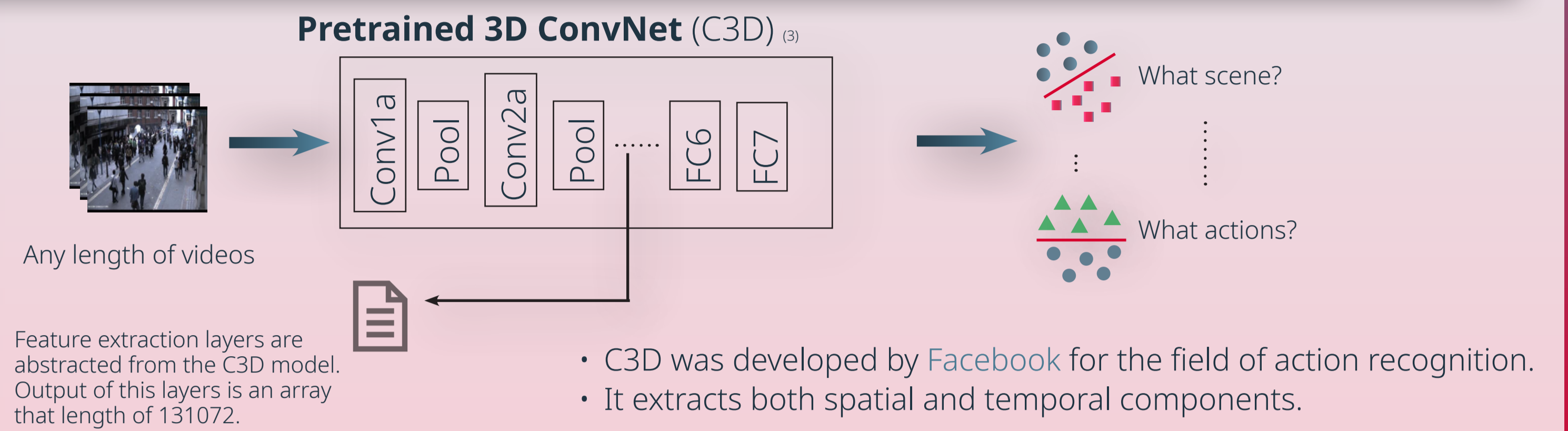


REFERENCES

- <https://www.crcv.ucf.edu/projects/real-world/> (Date of access: 07/06/2020)
- <http://rose1.ntu.edu.sg/Datasets/cctvFights.asp> (Date of access: 07/06/2020)
- <https://research.fb.com/blog/2014/12/c3d-generic-features-for-video-analysis/> (Date of access: 07/06/2020)
- Icons by freepik.com, flaticon.com, iconfinder.com

FEATURE EXTRACTION

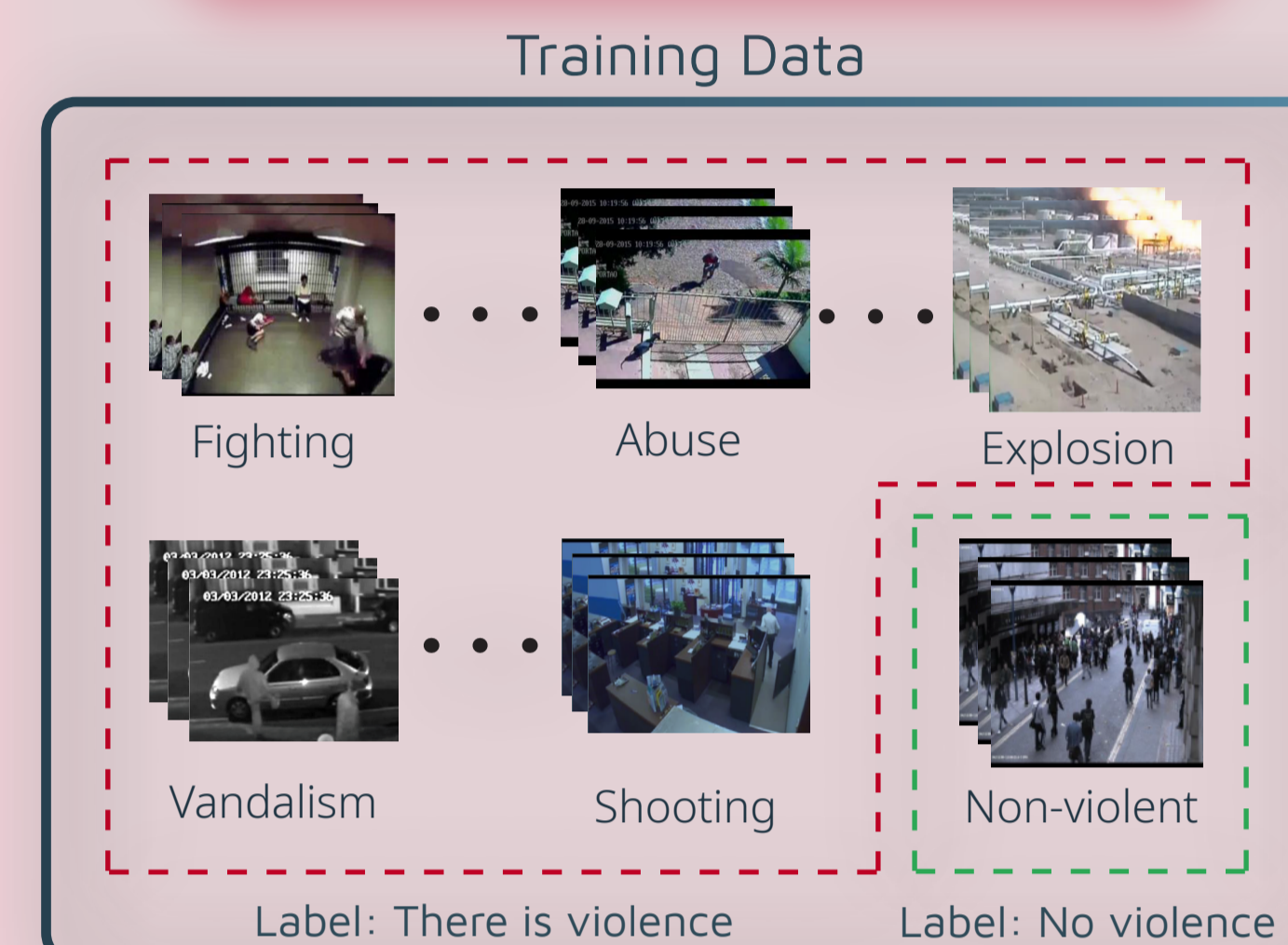
C3D



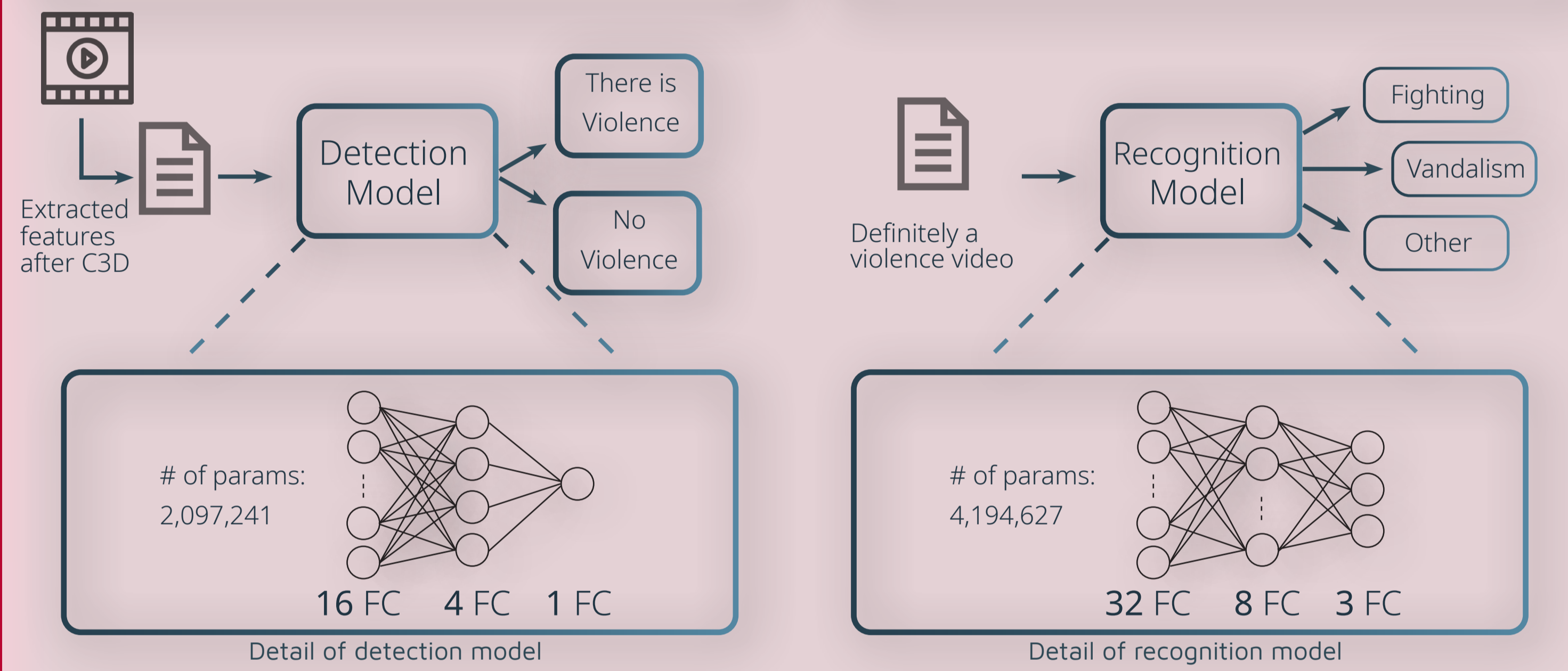
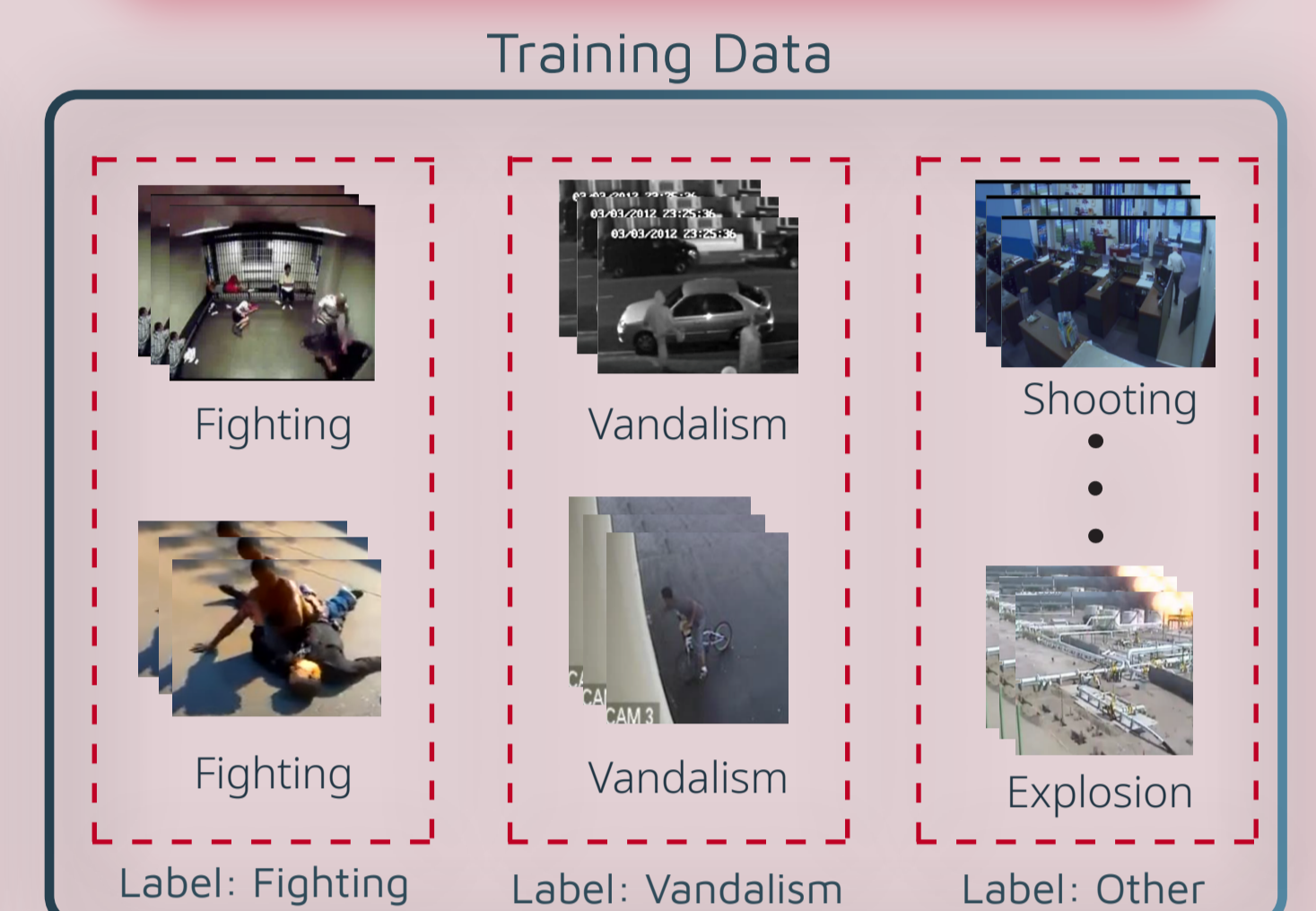
MODELS

Detection and Recognition

VIOLENCE DETECTION



VIOLENCE RECOGNITION



EXPERIMENTS

Tests & Results

In UCF Crime Data set;
Detection model was trained with 338 violent and 886 non-violent videos.
Recognition model was trained with a data set containing nearly 50 videos from each category.

UCF Crime Dataset	SVM		FC	
	Detection	Recognition	Detection	Recognition
Precision	0.88	0.56	0.90	0.61
Recall	0.96	0.51	0.94	0.60
F1	0.92	0.50	0.92	0.60
Accuracy	0.88	0.50	0.88	0.60
Time(s)	40±2.87	14.2±1.78	0.328	0.721 ± 0.234

*The average accuracy rate of violence recognition models on 13 types is nearly %30 in the literature.

In UCF Crime + NTU CCTV Fight Data set;
Detection model was trained with 857 violent and 886 non-violent videos.
Recognition model was trained with 619 fight, 50 vandalism and 50 other videos.

UCF Crime + NTU Fight	SVM		FC	
	Detection	Recognition	Detection	Recognition
Precision	0.88	0.53	0.93	0.29
Recall	0.96	0.53	0.93	0.33
F1	0.92	0.53	0.93	0.31
Accuracy	0.88	0.90	0.93	0.88
Time(s)	33 ± 1.3	19.4	0.307 ± 0.136	0.705 ± 0.106

CONCLUSION

- Since the main purpose of the project was to enable early intervention to fight and vandalism, we developed a slightly lower accuracy but 20% faster approach instead of complex models in the literature.
- The system we developed was made to reduce the manpower required to monitor, not to decide instead of the authorities. That's why success of detection is more important than recognize success.