WALCHAND COLLEGE OF ENGINEERING, SANGLI

MINI-PROJECT

THIRD YEAR B.TECH.

2018-2019

Department of Computer Science and Engineering

FALL ALERT

(A NOVEL APPROACH TO FALL DETECTION AT NIGHT)

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Problem Statement

- To detect and alert irrecoverable fall of armed forces/security personnel at night

Why we chose this problem?

- Armed forces are at continuous vigil at places of importance
- At night times, activity in the surrounding as well as visibility of the environment is relatively low
- Enemy can strike the personnel in silence and stealth

Problem Scenario

- Army/Security Personnel are guarding a place of high importance
- Its night and dark
- Two Situations of Irrecoverable Fall:
  - Ambush Attack
  - Cardiac Arrest or Similar
- A Secondary Surveillance Camera needed to alert such conditions

Objectives

- To study Objection detection through deep learning.
- To detect irrecoverable fall at night
- To reduce the processing time and be as real-time as possible
- Use Object detection + image processing to solve the given problem

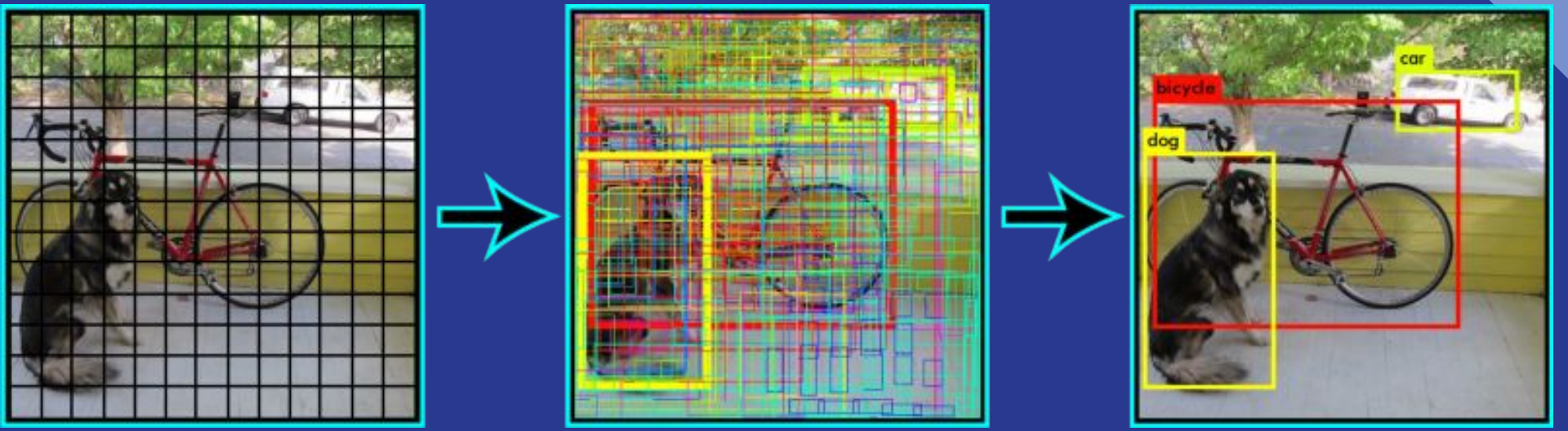
Literature Survey

- **Development of Human Fall Detection System using Joint Height, Joint Velocity and Joint Position from Depth Maps**
  - Equipment: Kinect v1 sensor with IR sensor stream
  - Accuracy: 96.55%
- **Classification of Human Fall from Activities of Daily Life using Joint Measurements**
  - Equipment: Kinect with Microsoft SDK v1.7. having IR sensor stream
  - Accuracy: 94.43%
- **Human Fall Detection from Depth Images Using Position and Velocity of Subject**
  - Equipment: Microsoft Kinect Sensor to compute velocity and position of the subject
  - Accuracy: 93.94%

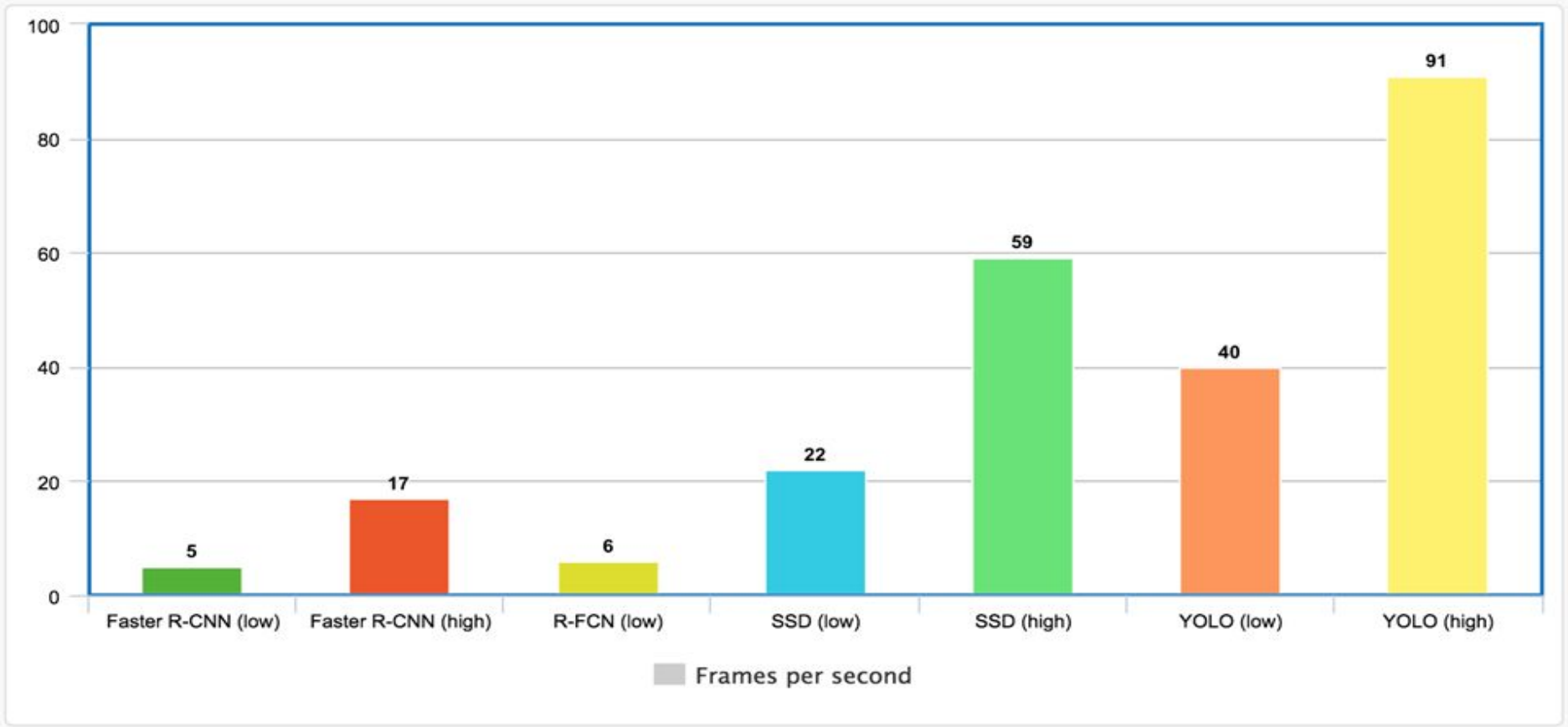
Why YOLO?

- RCNN / Fast R-CNN:
  - Two-stage Detector
    - 1) Selective Search 2) CNN for classification
  - Extremely slow
  - Not a complete end-to-end object detector
- Faster R-CNN:
  - Remove above bottlenecks
  - Region Proposal Network (RPN)
  - Very Accurate but **Very slow**
- Yolo: 1) One-stage detector strategy
  2) Significantly faster

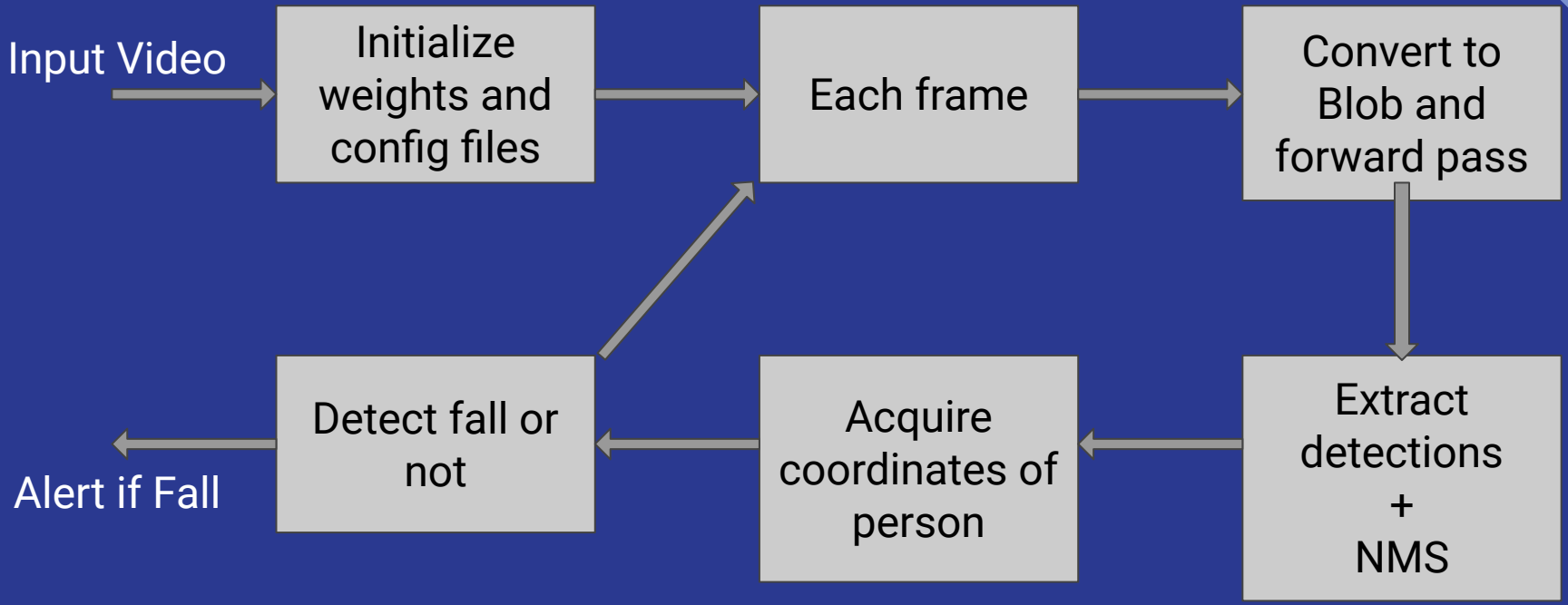
How YOLO works?



Why YOLO?


100
80
60
40
20
0
5
17
6
22
59
40
91
Faster R-CNN (low)
Faster R-CNN (high)
R-FCN (low)
SSD (low)
SSD (high)
YOLO (low)
YOLO (high)
Frames per second

Methodology



Results

Input Fall

Fall	No Fall	Total
1245	34	1299
657	14	717
800	15	1167
2702	63	3183

Precision	97.72%
Recall	84.88%
F1 Score	90.85%

Input No Fall

No Fall	Fall	Total
915	0	915
1455	0	1456
1657	0	1669
4027	0	4040

Precision	100%
Recall	99.67%
F1 Score	99.83%

Possible Bottlenecks

- Person Detection
- Orientation of the Camera

Future Scope

- Adapt the Solution for Old Age Homes
- Multithreading
- Improve fall detection accuracy using better image processing techniques.

References

- https://pjreddie.com/darknet/yolo/
- https://www.pyimagesearch.com/2018/11/12/yolo-object-detection-with-opencv/

THANK YOU