

# CMPE258 Review

May 12 (Th)

1. Final Exam Schedule:

May 24 (Monday) 1445-1700

a Video On All the time

b No References Allowed,  
No Cellphone Use. No  
messaging.

c Honor Code to Be Signed

d Last 4 Digits of SID

2. Class Feedback on-Line

3. Final Project Submission

Final Exam Review

85%  $\pm$  After the midterm

~ 4 Question. Design/Calculation

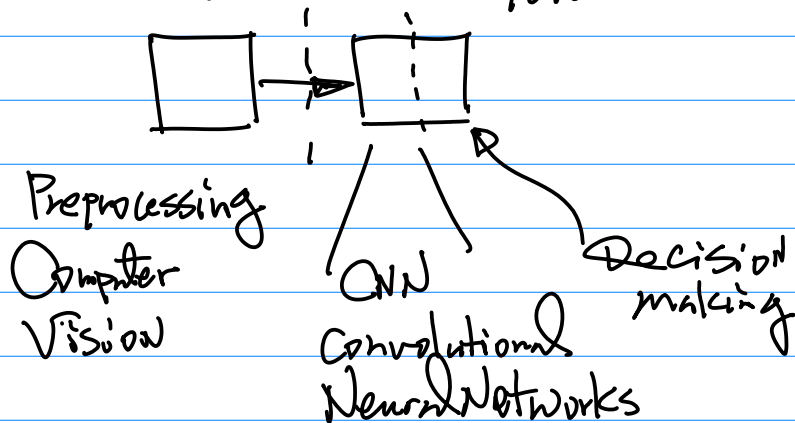
Questions About Basic Concepts  
in addition to Design Questions

Deep Learning for Object Recognition

Yolo Technique

Object Detection + Object  
R.O.I. Localization Recognition

1. Background



Feature Extraction

Feature Vector

4096 Back Bone

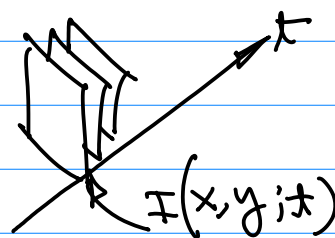
2. Object Tracker Technique

Centroid Based, Shortest

Distance Technique to track

multiple objects over a given

Period of Time



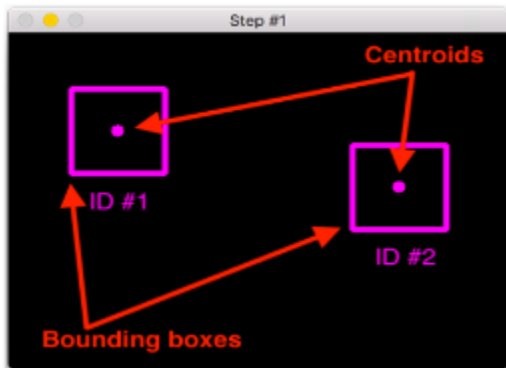
$I(x, y, t) \Rightarrow$  Preprocessing  $\Rightarrow$   
 $\bar{x}, \bar{y}$

Assign ID to Each Object, form  
Registration Table

Location ID  
( $\bar{x}, \bar{y}$ ) #

Shortest Distance Leads to the  
matching of the object from  
Previous frame @  $t$ , to the  
Current frame @  $t+1$ .

↓  
Match to All objects, update



Obj. No.	ID	x-bar, y-bar	
Object 1.	1	1,	2
Object 2.	2	5,	3

Then, Check Next Frame  
at  $t+dt$ , "Smoothness" →  
Shortest Distance Technique

$$\text{distance} \triangleq \sqrt{(x_i - x_j)^2 + (y_i - y_j)^2}$$

Between Object  $i$  and Object  $j$

( $\bar{x}_i, \bar{y}_i$ ), ( $\bar{x}_j, \bar{y}_j$ ) Substitute

these locations into distance  
finding equation.

So, we have a collection of  
distances

$$\{ \text{dist}_i \mid i=1, 2, \dots, k \}$$

Find the shortest Distance

Registration Table.

Note: For Extra point ( $\bar{x}, \bar{y}$ ),  
that means new Object appears,  
therefor, Add New ID in the  
registration Table.

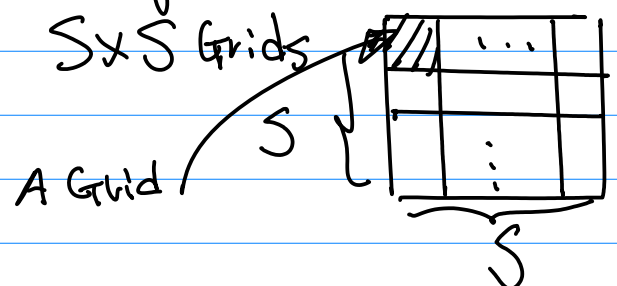
3. Feature Extraction.

Technique for Clustering  
Analysis.

Background: Yolo Technique

≡ Image  $I(x, y)$  is divided into

$S \times S$  Grids



## Probability of Ground Truth.

$$\Pr(\text{Class}_i | \text{Object}) * \Pr(\text{Object}) * \text{IOU}_{\text{pred}}^{\text{truth}} = \Pr(\text{Class}_i) * \text{IOU}_{\text{pred}}^{\text{truth}} \quad (1)$$

Technique for Cluster finding :

$$\arg \min_S \sum_{i=1}^k \sum_{\mathbf{x} \in S_i} \|\mathbf{x} - \mu_i\|^2 = \arg \min_S \sum_{i=1}^k |S_i| \text{Var } S_i \quad \dots (2)$$

See Hand Calculation Example on github.

$N=20$

Feature Vector  $\mathbf{x} = \begin{pmatrix} x_1 \\ x_2 \end{pmatrix}$ , 2D Feature Point.

Note: the Calculation of IOU  
(Intersection of Union) is  
required :

4. Evaluation of Yolo/CNN  
Performance Based on mAP.