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# **Object Recognition and Localization**

Badri Patro & Ganesh Boddupally

EE698M: Project Presentation Guidance: Prof. Tanaya Guha Indian Institute of Technology, Kanpur

April 25, 2016



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 This presentation will address Object Recognition and Localization in a video.

Detect and recognize a particular object in a video and then find out corresponding timing details of that object present in the video sequence, i.e, what are frames that object is available or the different time interval this object is available in the video scene.

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## Block diagram of Proposed Algorithm:



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#### Object Detection

# **Object Detection methods:**

- Frame Difference
- Mean Filter
- GMM

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## **Object Detection methods:**

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## **Object Detection Method 1:**



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#### Object Detection

# **Object Detection Method 2:**



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## Training:

## Extract Key Points locations using the Grid method.

- GridStep is [8 8] and
- BlockWidth is [32 64 96 128] :to take care of Scale Information
- Feature Descriptors: Extracting SURF features from the selected interest point.
  - Strongest Features: 80 percent of the strongest features.
  - Find the minimum no of strongest feature among all the data set.
  - Lets say M is minimum no of feature among all N(14) Image data set, each is having 100,200, 300 images.

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## Clustering: Approximate Nearest Neighbor is used to cluster all the feature .

- Divide Complete features into K(500) visual vocabulary words.
  - Number of clusters (K): 500.
  - Number of features : M\* N;
  - Initialization the cluster centers
  - termination criteria: 100 time loop or cluster distance error j threshold.

## Feature Histogram:

- Generate No of word count present in each cluster
- per each image find how many word are present in 500 cluster.
- each cluster represent as visual word index(500 visual index)

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# Training data : Repeat privious two slide for each image in the training set to create the training data

Generate 101 feature histogram for car training image.similarly generate feature histogram all training image.

## Feature Histogram:

- Generate No of word count present in each cluster
- per each image find how many word are present in 500 cluster.
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## Classifier:

- Encoded training images from each category are fed into a classifier training process.
  - The function trains a multiclass classifier using the error-correcting output codes (ECOC) framework with the help of binary support vector machine (SVM) classifiers

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## **Results:**

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ObjectR Star	ecogn t of	_ ition Train	Training ingObjec	gTestin ctClass:	g ifier f	- lunctio	n						
object_description =													
Colum	ns 1	throu	gh 6										
'ca	r_sid	e'	'Leopar	rds'	'ant'	'bu	tterfl	У'	'Moto	rbikes'	'f	erry'	
Colum	ns 7	throu	gh 13										
'cu	p'	'ele	phant'	'pano	da'	'cub'	'ca	r'	'tige:	r_carto	on'	'rhind	•
Colum	n 14												
'11	on'												
object_	count	=											
123	200	4	2 91	798	67	57	64	38	32	101	40	59	40
object_	count	=											
32	32	3	2 32	32	32	32	32	32	32	32	32	32	32

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### **Results:**

Creating Bag-Of-Features from 14 image sets.

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- \* Image set 1: car\_side.
  \* Image set 2: Leopards.
- Image set 2: Leopards
- \* Image set 3: ant.
- \* Image set 4: butterfly.
- \* Image set 5: Motorbikes.
- \* Image set 6: ferry.
- \* Image set 7: cup.
- \* Image set 8: elephant.
- \* Image set 9: panda.
- \* Image set 10: cub.
- \* Image set 11: car.
- \* Image set 12: tiger\_cartoon.
- \* Image set 13: rhino.
- \* Image set 14: lion.
- \* Extracting SURF features using the Grid selection method.
- \*\* The GridStep is [8 8] and the BlockWidth is [32 64 96 128].

*	Extracting	features	from	10	images	in	image	set	1done.	Extracted	38000	features.	
*	Extracting	features	from	10	images	in	image	set	2done.	Extracted	15360	features.	
*	Extracting	features	from	10	images	in	image	set	3done.	Extracted	40128	features.	
*	Extracting	features	from	10	images	in	image	set	4done.	Extracted	44688	features.	
*	Extracting	features	from	10	images	in	image	set	5done.	Extracted	25552	features.	
*	Extracting	features	from	10	images	in	image	set	6done.	Extracted	33744	features.	
*	Extracting	features	from	10	images	in	image	set	7done.	Extracted	48336	features.	
*	Extracting	features	from	10	images	in	image	set	8done.	Extracted	44536	features.	
*	Extracting	features	from	10	images	in	image	set	9done.	Extracted	47272	features.	
*	Extracting	features	from	10	images	in	image	set	10done	. Extracted	32060	) features.	
*	Extracting	features	from	10	images	in	image	set	11done	. Extracted	1 13824	reacures.	
*	Extracting	features	from	10	images	in	image	set	12done	. Extracted	32760	features.	
*	Extracting	features	from	10	images	in	image	set	13done	. Extracted	41800	) features.	
*	Extracting	features	from	10	images	in	image	set	14done	Extracted	17732	features.	

Badri and Ganesh Object Recognition

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of Proposed Algorithm: Object Detection Object Recognition

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\*F:\Course\_Work\_PhD\Course\_Work\_ITK\MATLAB\_Workspace\Video\_Processing\_EE608A\EE698M\_Course\_Projects\Complete\_BK\Computer\_Vision\_Project\11\_04\_16\object\_recognition\_trr FI\Course\_Work\_PhD\Course\_Work\_ITK\MATLAB\_Workspace\Video\_Processing\_EE608A\EE698M\_Course\_Projects\Complete\_BK\Computer\_Vision\_Project\11\_04\_16\object\_recognition\_trr FI\Course\_Work\_PhD\Course\_Work\_ITK\MATLAB\_Workspace\Video\_Processing\_EE608A\EE698M\_Course\_Projects\Complete\_BK\Computer\_Vision\_Project\11\_04\_16\object\_recognition\_trr

ne t	tait search view encoding Language settings macro kun Piugins window :
6	🖶 🗞 🗞 🍓   🔏 噛 [  2 4 4   # 🛬   4 4 4   2 5   5 1 1 🧱 2 5 2 1 0 0 0 0 0 0 0
🗧 Assig	prment_3_Report Lex 🖬 Assignment_2_Report Lex 🖾 📄 CreateObjects m 🖄 📄 Assignment_1_EE627A Lex 🕮 💼 CS676A_Project_Proposal Lex 🖾 🚔 EE698M_Paper_Presentation Lex 🕮 🖬
56	* Extracting features from 10 images in image set 6done. Extracted 33744 features.
57	* Extracting features from 10 images in image set 7done. Extracted 48336 features.
58	* Extracting features from 10 images in image set 8done. Extracted 44536 features.
59	* Extracting features from 10 images in image set 9done. Extracted 47272 features.
60	* Extracting features from 10 images in image set 10done. Extracted 32060 features.
61	* Extracting features from 10 images in image set 11done. Extracted 13824 features.
62	* Extracting features from 10 images in image set 12done. Extracted 32760 features.
63	* Extracting features from 10 images in image set 13done. Extracted 41800 features.
64	* Extracting features from 10 images in image set 14done. Extracted 17732 features.
65	$\frown$
66	* Keeping 80 percent of the strongest features from each image set.
67	
68	* Balancing the number of features across all image sets to improve clustering.
69	** Image set 11 has the least number of strongest features: 11059.
70	** Using the strongest 11059 features from each of the other image sets.
71	
72	Vising K-Means clustering to create a SUU word visual Vocabulary.
73	Number of leatures (1348/6-)
71	* Number of clusters (K) : 500
75	* Trificiary alugtor approve 10 4050 5050 9051 0051 2051 4051 5051 9052 2052 4052 5052 9059 2059 4059 5059
70	- Initializing Clubber conternate once once contervations reast one contervations rate once once once once once once once onc
78	547 20537 40537 60537 80538 00538 20538 40538 60538 80530 00530 20530 40530 60530 80540 00540 20540 40540 80541 80541 00
79	542 40542 60542 80543 00543 20543 40543 60543 80544 00544 20544 40544 60544 800557 00557 20557 40557 60557 80555 00558 2
80	376 20876 40876 60876 80877 00877 20877 40877 60877 80878 00878 20878 40878 60878 80879 00879 20879 40879 80880 00
81	\$77.20\$97.40\$97.60\$97.80\$98.00\$98.20\$98.40\$98.60\$98.80\$99.00\$99.20\$99.40\$99.60\$99.80\$100.00\$.
82	
83	
84	* Clusteringcompleted 0/100 iterations completed 1/100 iterations ~0.71 seconds/iteration) completed 2/100 iterations
85	3/100 iterations (~0.57 seconds/iteration) completed 4/100 iterations (~0.73 seconds/iteration) completed 5/100 iterations
86	30/100 iterations (~0.70 seconds/iteration)completed 31/100 iterations (~0.59 seconds/iteration)completed 32/100 iterati
87	33/100 iterations (~0.58 seconds/iteration) completed 34/100 iterations (~0.56 seconds/iteration) completed 35/100 iterati
88	36/10 iterations (~0.70 seconds/iteration)converged in so iterations.
89	
90	* Finished creating Bag-Of-Features
91	
92	
•	

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**Results:** 

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T	raining an	n image category classifier for 14
		$\sim$
*	Category	1: car_side
*	Category	2: Leopards
*	Category	3: ant
*	Category	4: butterfly
*	Category	5: Motorbikes
*	Category	6: ferry
*	Category	7: cup
*	Category	8: elephant
*	Category	9: panda
*	Category	10: cub
*	Category	11: car
*	Category	12: tiger cartoon
*	Category	13: rhino
*	Category	14: lion
*	Encoding	features for category 1done.
*	Encoding	features for category 2done.
*	Encoding	features for category 3done.
*	Encoding	features for category 4done.
*	Encoding	features for category 5done.
*	Encoding	features for category 6done.
*	Encoding	features for category 7done.
*	Encoding	features for category 8done.
*	Encoding	features for category 9done.
*	Encoding	features for category 10done.
*	Encoding	features for category 11done.
*	Encoding	features for category 12done.
*	Encoding	features for sategory 13done.
*	Encoding	features for category 14done.
*	Finished	training the category classifier.

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#### Introduction

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Block diagram of Proposed Algorithm:

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### **Results:**

* The confusion	The confusion matrix for Training bet is:													
KNOHN	car_side	Leopards	ant	butterfly	Notorbikes	ferry	PREDIC cup	IED elephant	panda	cub	car	tiger_cartoon	rhino	lion
car side	1.1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Leopards	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ant	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
butterfly	0.00	0.10	0.00	0.80	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00
Motorbikes	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ferry	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
cup	0.00	0.00	0.00	0.00	0.10	0.00	0.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00
elephant	0.10	0.10	0.00	0.00	0.00	0.00	0.00	0.80	0.00	0.00	0.00	0.00	0.00	0.00
panda	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
cub	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
car	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00
tiger cartoon	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
rhino	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.90	0.00
lion	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.90

\* Average Accuracy is 0.95.

confusion\_matrix\_training\_set

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Badri and Ganesh

Object	Results:
Recognition and Localization	Evaluating image category classifier for 14 categori
Badri Patro & Ganesh Boddupally	<pre>* Category 1: car_side * Category 2: Leopards * Category 3: ant * Category 4: butterfly * Category 5: Motorbikes * Category 5: ferry</pre>
Introduction Problem Statement	<pre>Category 0: cup * Category 0: cup * Category 0: elephant * Category 9: panda * Category 10: cub</pre>
Proposed Algorithm	<ul> <li>Category 10: car</li> <li>Category 12: tiger cartoon</li> <li>Category 12: tiger cartoon</li> </ul>
Block diagram of Proposed Algorithm:	Category 14: lion     * Evaluating 22 images from category 1dope.
Object Detection Object Recognition Approached	* Evaluating 22 images from category 2done. * Evaluating 22 images from category 3done. * Evaluating 22 images from category 4done. * Evaluating 22 images from category 5done. * Evaluating 22 images from category 5done.
Training Results Object	<ul> <li>Evaluating 22 images from category 6done.</li> <li>Evaluating 22 images from category 8done.</li> <li>Evaluating 22 images from category 8done.</li> <li>Evaluating 22 images from category 9done.</li> </ul>
Code Sequence	<ul> <li>Evaluating 22 images from category 11done.</li> <li>Evaluating 22 images from category 12done.</li> <li>Evaluating 22 images from category 13done.</li> <li>Evaluating 22 images from category 14done.</li> </ul>
Reference	* Finished evaluating all the test sets.
	★ The confusion matrix for this test set is: < □ > < □ > < □ > < □ > < ≥ > < ≥ > ≥

**Object Recognition and Localization** 

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### **Results:**

\* The confusion matrix for this test set is:

Proposed Algorithm

of Proposed Algorithm:

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							PREDICT	CED						
RNOWN	car_side	Leopards	ant	butterfly	Motorbikes	ferry	cup	elephant	panda	cub	car	tiger_cartoon	rhino	lion
car_side	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Leopards	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ant	0.05	0.00	0.05	0.41	0.05	0.00	0.05	0.05	0.14	0.05	0.00	0.00	0.05	0.14
butterfly	0.00	0.00	0.09	0.27	0.14	0.00	0.09	0.05	0.14	0.05	0.00	0.00	0.05	0.14
Motorbikes	0.00	0.00	0.05	0.00	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ferry	0.32	0.00	0.00	0.00	0.09	0.41	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.00
cup	0.23	0.00	0.00	0.09	0.14	0.00	0.32	0.00	0.14	0.00	0.05	0.00	0.05	0.00
elephant	0.09	0.00	0.00	0.05	0.05	0.05	0.00	0.23	0.05	0.14	0.00	0.05	0.18	0.14
panda	0.00	0.00	0.00	0.23	0.18	0.00	0.00	0.09	0.32	0.05	0.00	0.00	0.05	0.09
cub	0.05	0.14	0.05	0.00	0.00	0.00	0.00	0.05	0.00	0.41	0.00	0.09	0.05	0.18
car	0.18	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.05	0.00	0.68	0.00	0.00	0.00
tiger cartoon	0.00	0.14	0.00	0.00	0.00	0.05	0.14	0.00	0.00	0.05	0.00	0.50	0.00	0.14
rhino	0.05	0.14	0.00	0.05	0.00	0.05	0.05	0.05	0.05	0.14	0.00	0.05	0.32	0.09
lion	1 0.00	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.09	0.00	0.77

\* Average Accuracy is 0.52.

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## Approches:

Object proposed

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- Object proposed
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## **Code Sequence Flow:**



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### **Code Sequence Flow:**

'object is' 'Motorbikes' ',object id '2' ', present frame' 133 ', no of ob1 in frame' 121 'object is' 'Leopards' .object id '.present frame' 134 ', no of obj in frame' 'object is' 'lion' ', object 1d ! '.present frame' '134' ', no of obj in frame' 'object is' 'ferry' ', object id ', present frame' 135 ', no of obj in frame' '2' 'object is' 'car' ',object id ' 121 ',present frame' '135' ', no of obt in frame' 'object is' 'ferry' '.object id '.present frame' 136 '.no of obt in frame' 121 'object is' 'car! ', object id ! ', present frame' 1361 ', no of obj in frame' 121 'object is' 'car side' ', object id ',present frame' 1371 ', no of obj in frame' 121 121 'object is' 'car' '.object id 121 ',present frame' '137' ', no of obl in frame' 'object is' 'ferry' '.object id 111 '.present frame' 138 ', no of obj in frame' 121 'object is' 'car' ', object id ' '.present frame' 1381 ', no of obj in frame' 121 'object is' 'car' ', object id ' 111 ', present frame' 1391 ', no of obj in frame' 'object is' 'car' ',object id ' '2' ',present frame' '139' ', no of obt in frame' 'object is' 'ferry' '.object id 111 '.present frame' 140 ', no of obj in frame' 121 'object is' ', object id ' '.present frame' 140 ', no of obj in frame' 121 'car' 'object is' 'car' ', object id ' 111 ', present frame' 11411 ', no of obj in frame' 'object is' 'Motorbikes' ',object id ' '2' ',present frame' 141 ', no of obt in frame' '2'

#### Reference

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Results Obiect

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