



# AI, Computer Vision and Emerging Opportunities

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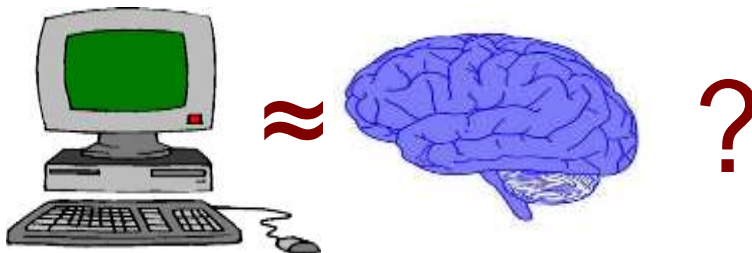
[www.iiit.ac.in/~jawahar](http://www.iiit.ac.in/~jawahar)



# Modern “AI”



NLP



Computer  
Vision



Speech Processing



Robotics



# What is Modern “AI” ?

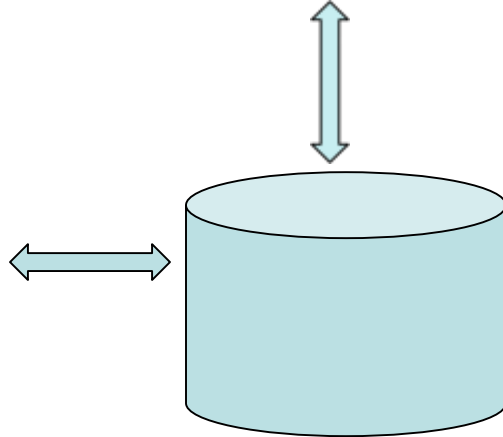


**Data Driven Intelligence**



# Data and Analytics: Big Data (!)

- AI
- Machine Learning
- Data Mining
- Data Science
- Analytics

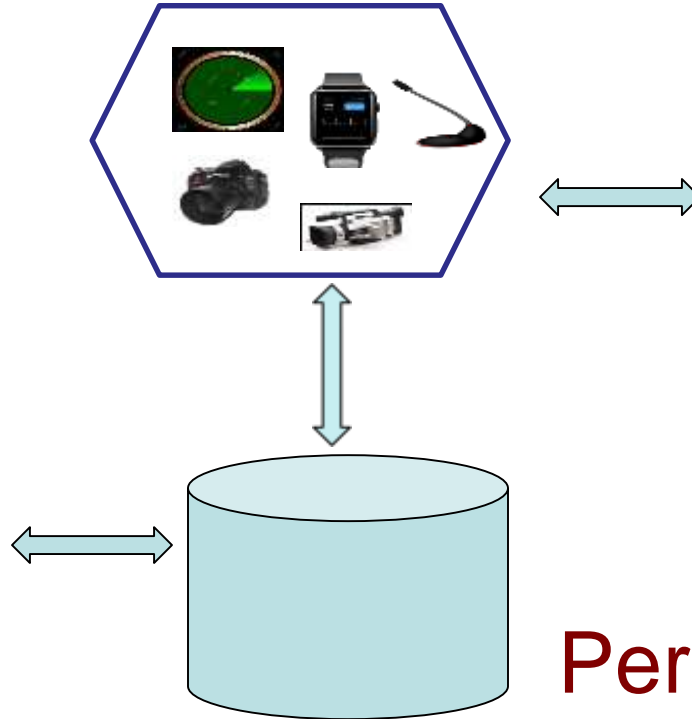


**Transactional Data**



# Data and Analytics: Big Data ?

- AI
- Machine Learning
- Data Mining
- Data Science
- Analytics



**Perception and  
Intelligent Sensing**



# Sensing

*What a simple GPS could do?*



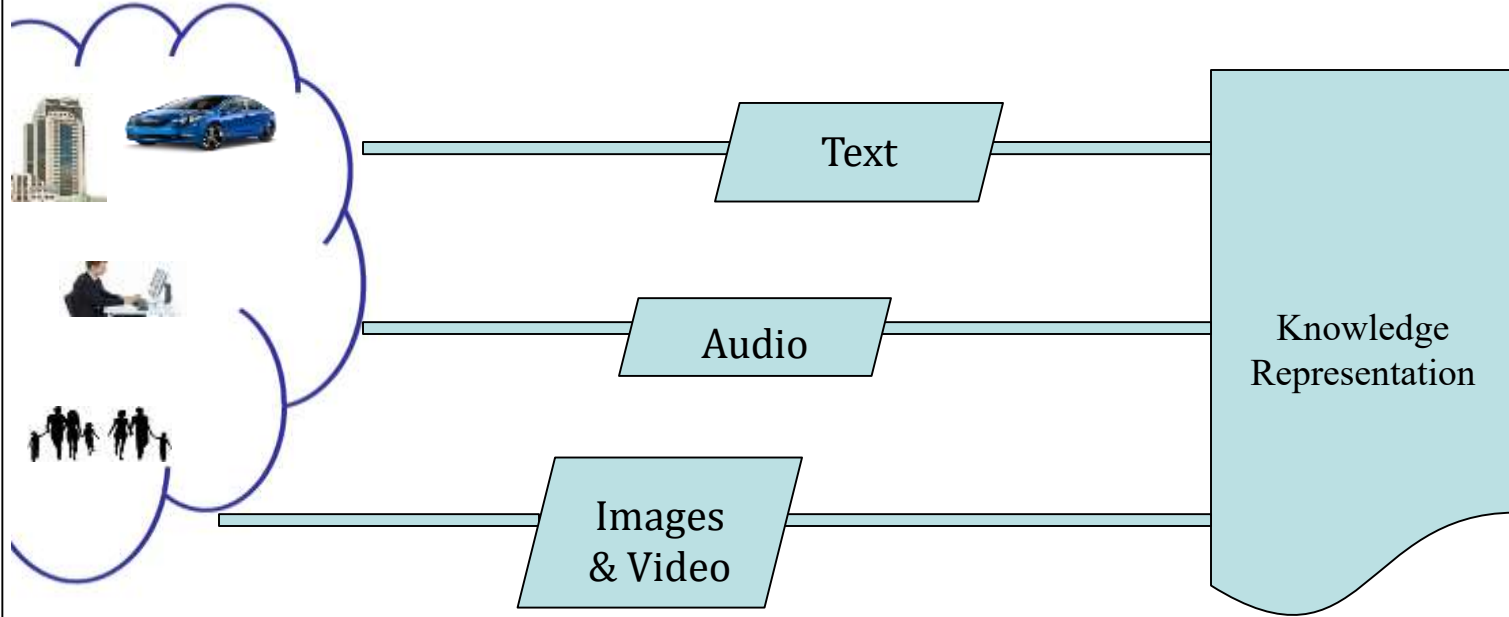
*Speech is already there*



*Let us be ready for the vision ..*



# AI and Interfacing with the world



A  
P  
P  
L  
I  
C  
A  
T  
I  
O  
N  
S



# Better Man-Machine Interfaces

Vision (I) + Language (O)

Connecting “Real World” and the Digital World





# Assistance to the Disabled



# Smart Sensing and Interfacing

- Connect “real world” to a digital symbolic/numerical representation
- Enable recommendation, promotions, bid/bargain, etc.



*Data mining in “real world”*



*Eg. Fashion and Traffic*



# First Person Vision



***Virtual/Augmented Reality***



***Police/Security: Real time interface***



***Social Computing***



***Who goes with whom?***



***Research and Explorations: Wild life***



# Breaking The Limits

Can I get the “IIT education” without topping “JEE”?

Can I learn machine learning from Hinton ?



*Technology: Web+Systems*

Can I learn bowling from Ashwin?

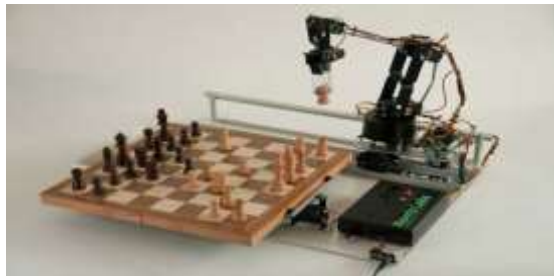


*Technology: AI, Vision, Robotics*





# Enable AI in “Real Sports”



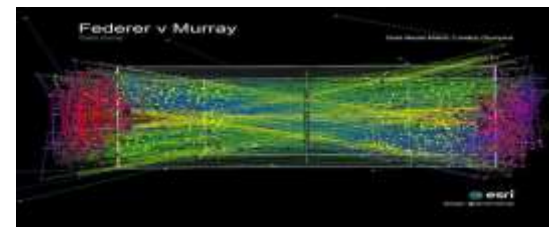
**Chess: Success story of AI.**



**Can machines have eyes?**



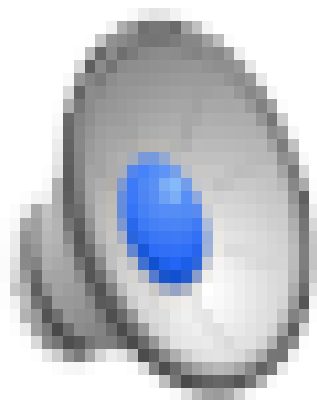
**Cameras Beyond Broadcasting ?**



**Automated Sports Analytics**



# Example: Badminton



Location,  
Actions,  
Patterns.

Planning,  
Mining,  
Coaching

# What enabled?

## Dataset for Badminton Analytics



Clear



Smash



Back and  
Forth

Component	Classes	Total	Train	Test
Matches	NA	10	7	3
Players	2	20	14	6
Player bboxes	2	2988	2094	894
Point segments	2	751	495	256
Strokes (Partial)	6	5984	3583	2401

Forehand, Backhand, Smash, Serve,  
React, None. 6X2 =12 classes



# AI and Physical Infrastructure?



## Advances in Digital World

Shortest Path, Routing  
Planning and Scheduling  
AI, Games and Learning

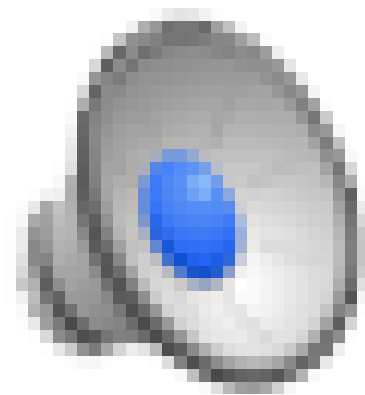




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# AI for Efficiency and Safety





# Road is a Complex Entity



Roads



Pedestrians



Traffic systems



Bike riders



Support  
infrastructure



Cars and  
trucks



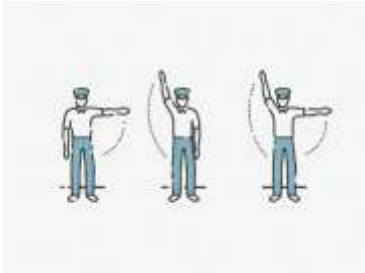
Plantation



Billboards and food  
vendors



# Road is a Complex Entity



Traffic Police



Law court



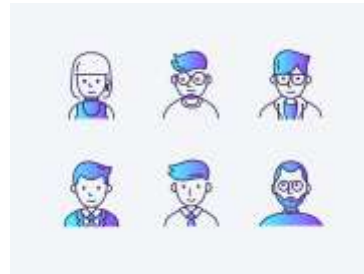
Road transport authorities  
of different states



Road transport  
ministry



Municipal  
corporations



Indian Road  
Congress



State - Roads and  
Building corporations



National Highways  
Authority of India



# Vision on/for Vehicles





# Vision: What do we want to see?

- Driver
  - Face, Identity, Expression, State, Eyes, Gaze
- Driving
  - Quality, Violations, Good practices, Overtaking, Relative speed
- Objects and Scenes
  - Animals, Junctions, Bus stops, Obstacles
- Road
  - Water, Potholes, Construction
- Infrastructure
  - Signals, Sign Boards
- Traffic
  - Density, Patterns
- Where?
  - Location in image, Location on Maps, Distance (3D/Depth)

# Challenging Indian Outdoor



Invisible Signs



# Challenging Indian Outdoor



Complex Driving Patterns



# Challenging Indian Outdoor



Roads and Construction: No ends, Signals and Boundaries



# Challenging Indian Outdoor



Many, Diverse Participants in the Traffic



# Success of Modern AI



Availability of data leads to solutions that generalize and apply to new real world situations



# Data Set on/for Indian Roads



## Features

- Indian Roads
- Multimodal Data
- Annotations for Popular Tasks
- Double the size of popular Datasets available now.
- Challenge at ECCV 2018 (AUTONUE)

## Open for Research and Academic Activities

### Vision Tasks

Detection  
Classification  
Segmentation  
Pose etc.

### Data Types

City and Rural  
Black and Muddy  
Changing Weather  
Day and Night  
Multimodal

### Domain

Perception  
Prediction  
Inspection  
Intent

**Available for Free Download**

# Diversity & Unstructured Conditions

## Odd-shaped vehicles, challenging drivable areas



## Pedestrians & jay-walkers





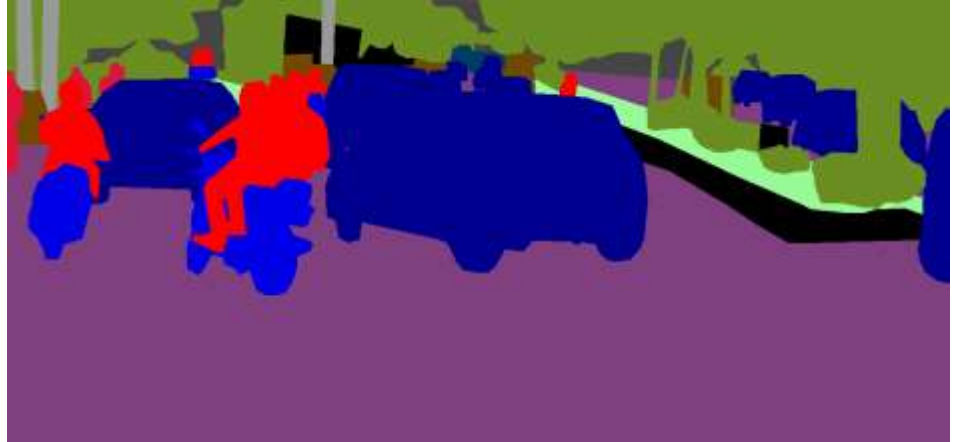


# Data Set – Coarse & Fine Annotations

Input



Fine



Coarse



# Vital Statistics

**10,000**

Image / Label  
Pairs



**180**

Drive Sequences



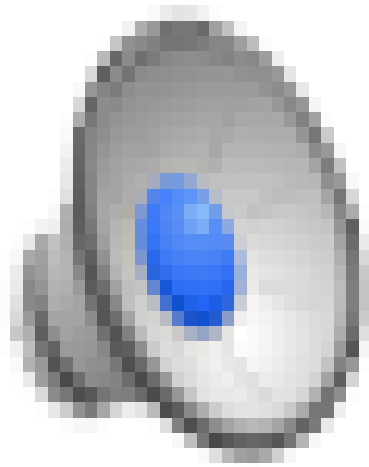
**34**

Class labels



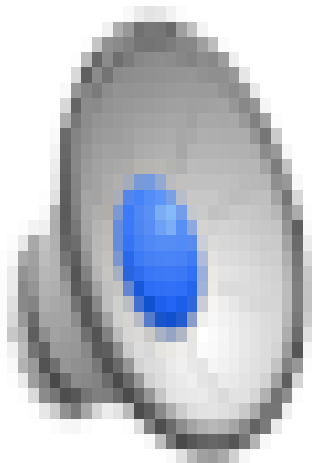
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# Examples





# How Hard?



Baseline:  
COMPARISON

Western : **70**  
Ours : **20**  
(adapt) : **40**

- Harder/Challenging
- Domain/drift





# Are the problems getting solved ? NO

- Rather, **problems are now getting understood** and depths are being estimated.
- “Real” Indian outdoor is an order more harder than what we have in the data set.
  - Further Attempts are ongoing.
- Fine (highly accurate understanding) is too far.
- **What can we do meanwhile?**



Example:

A Simple Solution to City Scale Road Audit

# Scope



Pothole



Water-log



Pothole + Muddy Road



Muddy Road



Rough Road



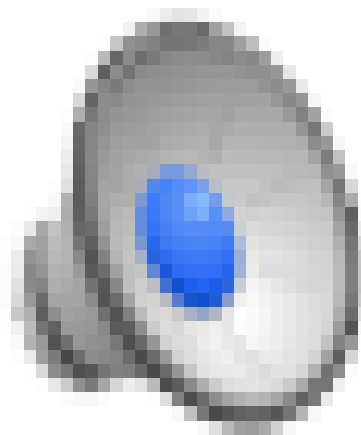
Wet Road



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# Input: Mobile Phone Video





# Need for Data Sets that Drive Solutions

- Large Natural Outdoor Data
  - Objects and their interactions on our outdoor
  - Computational models for Driving, Driver Patterns, Behaviors
  - Detecting Violations, Enforcements, Educating
- AI Solutions for
  - Driver and Vehicle Assistance in Indian Setting
  - Assistance for Enforcing Agencies
  - Roads and natural outdoor inspection, maintenance, logging
  - Enabling Citizens to Contribute to Enhance the Safety



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# Computer Vision: Bridging the worlds

- **Real World**
  - Problems of estimating the state/situation
  - Breaking the limits of resources/scales
  - Human and electro-mechanical systems
- **Digital World**
  - Deployable and actionable knowledge from data
  - Smarter and efficient algorithms
  - Planning, Strategies and Interactions



Thank you!!

Comments?