
CMInDS

Indian Institute of Technology Bombay

**Programming for Machine Learning and Data Science**

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# Course Project Description Document

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# Object Detection: Cricket Bat, Ball, and Stumps

## Overview:

- This project carries 20 marks (20% weightage)
- It must be done in groups of max 5 members.
- **Submission deadline**: Dec 7, 2025 , 23:55 Hrs
- Evaluation Mode: Based on the presentation, video, and submitted artifacts (dataset, code, weights, CSV outputs).

## Problem Description:

You are required to build a model that detects whether regions in a cricket image contain a bat, a ball, stumps, or no object (if there are none). In this exercise, you must create your own dataset, for example, by downloading images from the Internet.

## Dataset:

- The data set (at least 300 images) needs to be created
- **Teams may collaborate on the creation of a common data set for training and testing the classification models**
- Images should include a balanced mix of:
    - Cricket bat images (various angles, partial/complete views)
    - Cricket ball images (on ground, in air, in hand, etc.)
    - Stumps (clear, occluded, etc.)
    - No-object images (grass, pitch, background scenes)
- Dataset requirements:
    - All images must have a 4:3 aspect ratio and be resized to 800 x 600 pixels.
    - Note: It is acceptable to downsize higher resolution images. Images with a resolution lower than 800x600 should NOT be scaled up / used
    - Include a short README file describing image sources.

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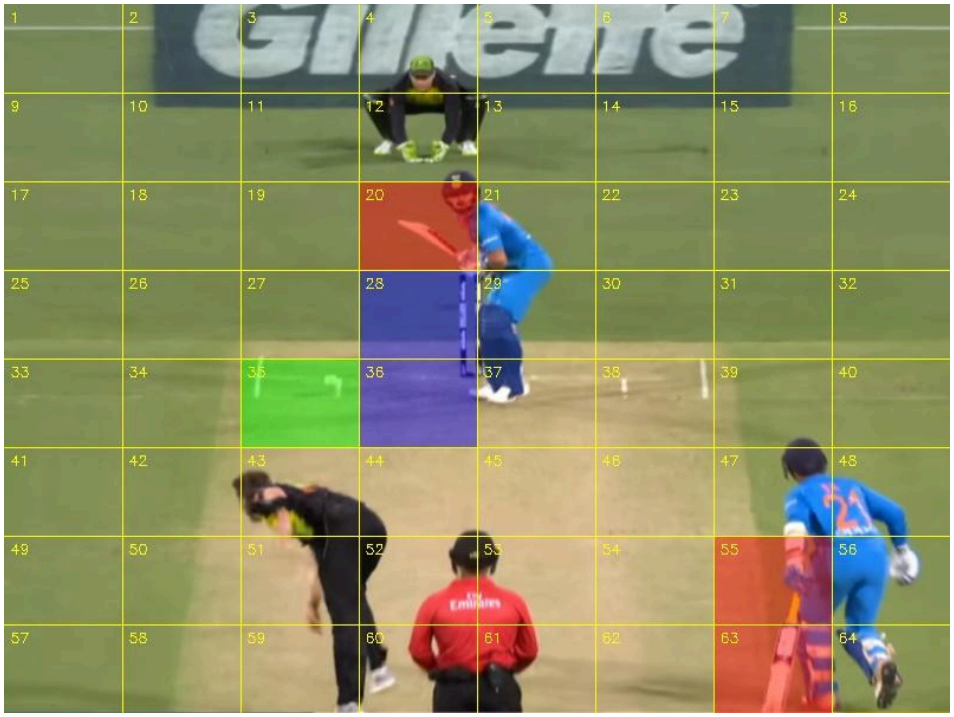
## Modeling Task:

- Divide each 800 x 600 image into an 8×8 grid (64 cells), as shown in the image below.
- Predict for each grid cell:
  - 0 → no object
  - 1 → ball
  - 2 → bat
  - 3 → stump
  - Note: In case multiple objects are present in a cell, the classifier should detect any ONE of them.
- Any **hand-crafted feature engineering techniques for images** can be used. This implies that methods like CNNs, or equivalents, that automatically create features from images, SHOULD NOT be used.
- Save the trained model as model_<teamname>.pkl.
- Run your final (best) model on both the train and test datasets and capture the outcome in a CSV file having the following format:
  - ImageFileName, TrainOrTest, c01, c02, …, c64
  - The value in each column should be 0, 1, 2, or 3 depending on the prediction, as enumerated above.

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For example, the entry in the CSV file for the above image will look as follows

- Column c35 should be marked as 1 since it contains the ball.
- Columns c20, c55, and c63 should be marked as 2 since they contain the bat.
- Columns c28 and c36 should be marked as 3 since they contain the stump.
- All remaining columns should be marked as 0, indicating no object.

## Deliverables:

| Deliverable | Description |
|---|---|
| Dataset | Minimum 300 images per team (with folder structure and README.txt explaining sources). |
| Source Code | All scripts/notebooks used for data processing, feature creation, model training, and inference. |
| Performance Metrics | On train/test data |
| Model Weights | Trained pickle file (.pkl). |
| Predictions CSV | Output file as specified above. |
| Presentation | Well-structured slide deck summarizing approach, methodology, metrics, and results.<br><br>See **Presentation Guidelines** below for more information |
| Video (about 5 minutes) | Overview of the entire workflow – data, features, model, results, challenges, and key learnings. |

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## Presentation Guidelines

- There is no limit on the number of slides in the presentation. The presentation should document all aspects of the project, but precisely and in a compact manner.
- The first/title slide should contain the roll numbers and names of all the team members.
- Following the title slide, there should be a maximum of 3 slides containing an executive summary,
- As mentioned above, the remaining slides should capture all aspects of the project: problem explanation; details of all the paths and steps taken; metrics; observations, analysis, conclusions; challenges, and learnings.
    - Note: Include all aspects of the project, including paths taken that resulted in dead-ends/failures / non-optimal results, etc. That is, it should document the entire efforts of the team.
- The video time should not exceed 5 minutes, and if it does by more than 15 seconds, there will be a penalty.

## Evaluation criteria

| Criteria | Marks |
|---|---|
| Problem detailing, solution approach, completeness of solution, and Data Science steps followed | 10 |
| Quality of results on the train/test data and also on hold-out data (ie, unseen data set used for evaluating the models); observations, analysis, conclusions | 10 |
| Documentation: Completeness and quality of the presentation and video | 05 |

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