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## Feature Generation For Scene Classification

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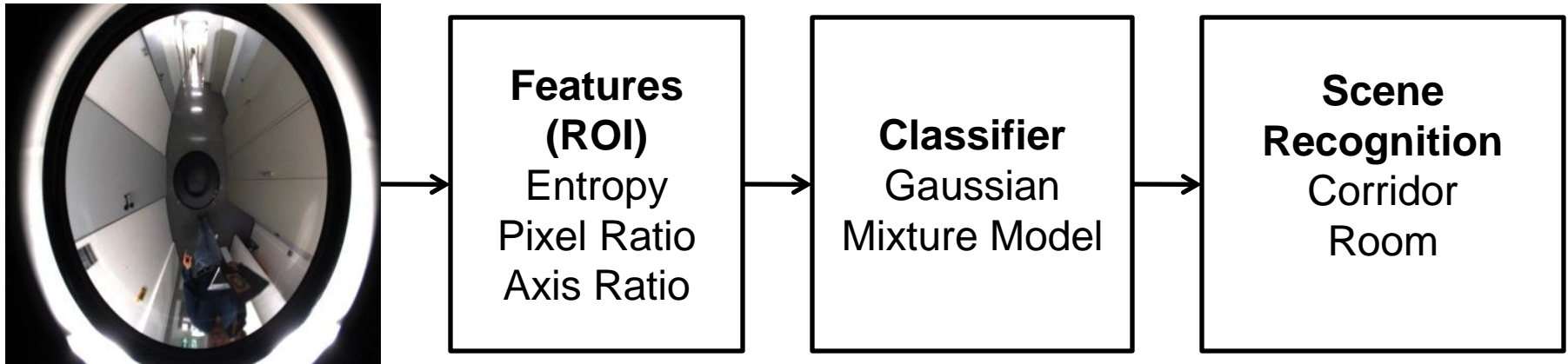
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# Problem Definition

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- **Extract raw image features from Omni directional images.**
- **Scene recognition**
  - **Assigning a single category to the entire image.**
- **Test analysis in images of real indoor environments**
  - **Evaluate the prediction accuracy.**

# Approach and Methodology



# Features Generated

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$$Entropy = -\sum f \log_2 f$$

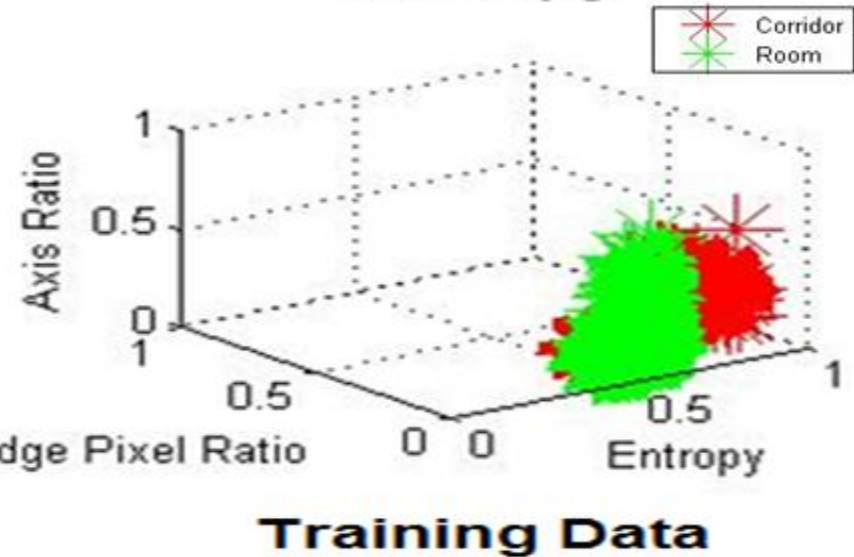
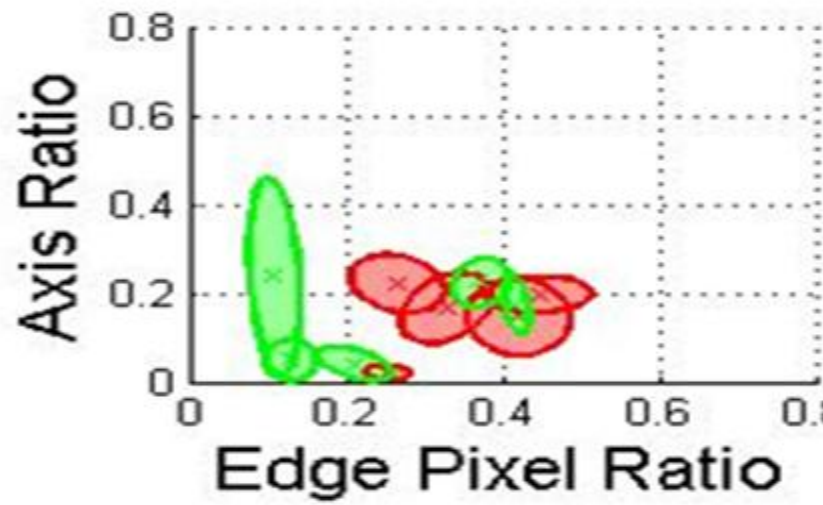
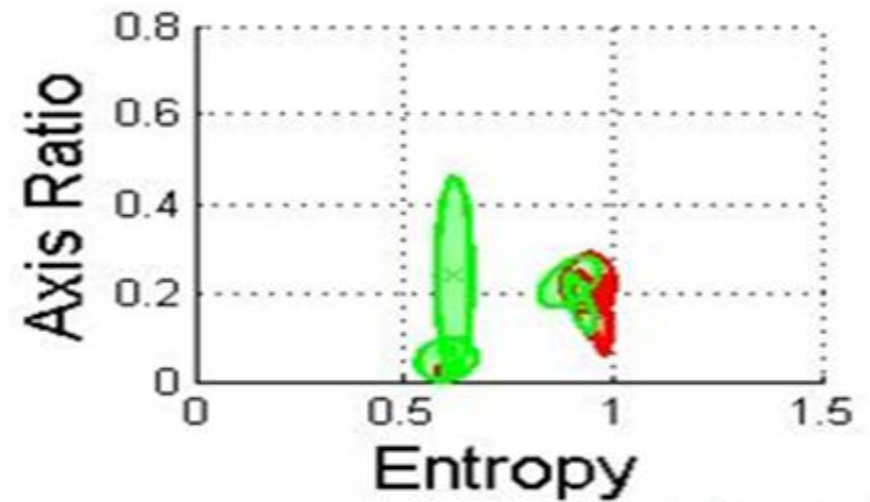
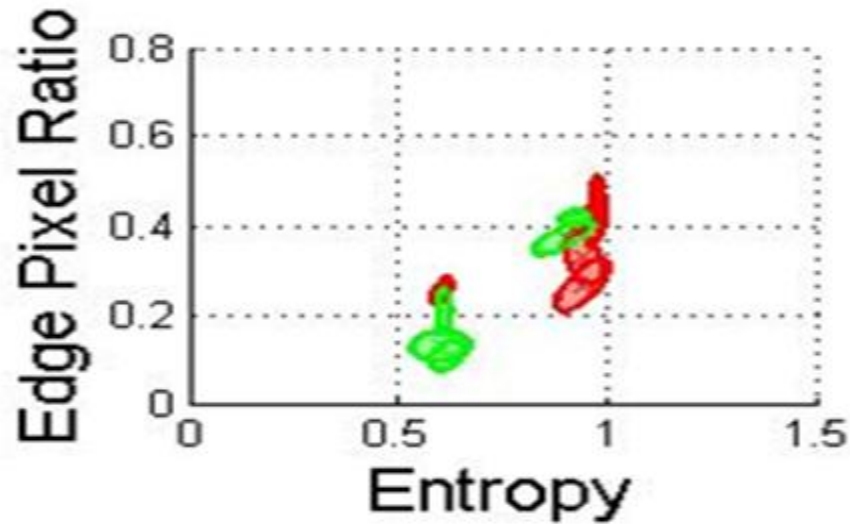
$$\text{Edge pixel ratio} = \frac{\text{Number of edge pixels}}{\text{Total number of pixels}}$$

$$\text{Axis ratio} = \frac{\text{Major principal Axis}}{\text{Minor principal Axis}}$$

# Experimental Design

- **Training dataset**
  - Images of different corridors and rooms – University and Internet
    - Corridor - 1500 Images
    - Room - 1500 Images
  - Comparison of feature values for the training data
  - Optimized Gaussian mixture model was developed
- **GMM Model**
  - Initialized using K-Means clustering based on the maximum Likelihood (ML) estimation using Expectation Maximization (EM)
  - Optimized model using BIC(Bayesian Information Criteria)
  - Probability Density Function (PDF) of a multivariate Gaussian – Deciding factor
- **Test dataset**
  - Total of 1000 images used
  - The test analysis carried out in three phases
    - Individual Analysis of Test Images
    - Analysis on Image Sequences
    - Prediction based on Voting Scheme

# GMM Model and Training Data



# Analysis and Results

## ■ Individual Analysis of Test Images

- Confusion matrix of individual image prediction

Actual Class		Prediction	
		Class	
		Corridor	Room
	Corridor	578	20
	Room	150	242

- Prediction percentage

Prediction percentage	
Corridor	0.96
Room	0.61
Overall	0.82

# Analysis and Results

- **Analysis on Image Sequences**
  - Prediction percentage on image sequence

Consecutive Combinations	Number of Images					
		5	10	25	50	100
	10	0.84	0.83	0.83	0.82	0.80
	30	0.823	0.803	0.793	0.793	
	50	0.814	0.790	0.792	0.794	



# Analysis and Results

## ■ Prediction based on Voting Scheme

- Confusion matrix of voting scheme prediction

Actual Class		Prediction Class		
		Corridor	Room	Unidentified
	Corridor	597	3	0
	Room	115	285	0

- Prediction percentage

Prediction percentage	
Corridor	0.995
Room	0.713
Overall	0.882

# Conclusion

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- **Relevant image features extracted from Omni directional images.**
- **Scene classification done using Gaussian Mixture Model**
- **Better prediction accuracy for voting scheme based test evaluation**