Bat-based Game Detection using HOG and SVM

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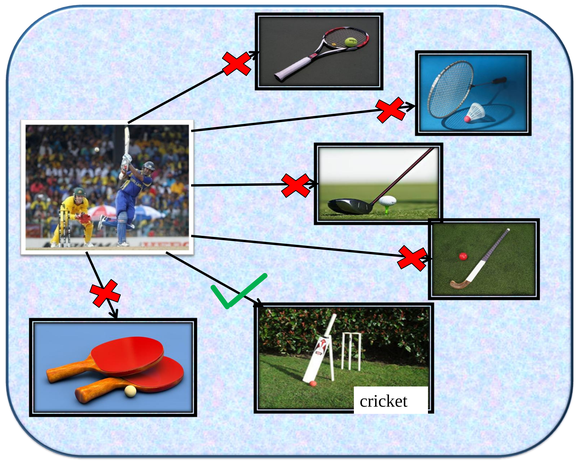
Introduction



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In this work we trained a system that identifies bat-based games based on the shape of the bat. We used Histogram of Gradient (HOG) descriptor to detecting keypoints from a static image and used a linear Support Vector Machine (SVM) to classify the image features. We have assembled a highly challenging database of six varied sport game events: Badminton, Cricket, Golf, Hockey, Table tennis and Tennis. We show that our system is capable of classifying those games at 83.42% average accuracy.

Objective

"To build a system that can learn to recognize bat-based games from two-dimensional images and to make the computer able to identify the game from given images without human intervention"

Methodology

Our approach involves two major steps:

❖ To describe shape, we use HOG descriptors [1].

❖ To classify the descriptors we use OVA-SVM classifiers [2]

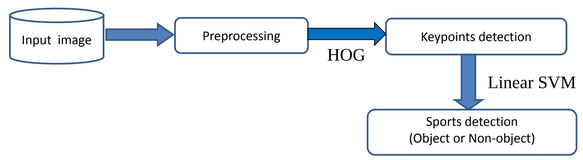


Figure 1: Methodology of the system

Parameters of HOG descriptor

This study implements the same design choices as the original HOG descriptors for human detection by Dalal and Triggs. Especially we are using the following parameter choices:

❖8×8 pixel cells
❖Block size of 2×2 cells
❖50% overlap between blocks
❖Bin-9
❖Unsigned-0

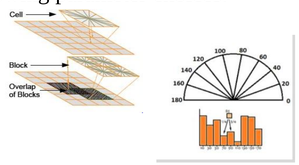


Figure 2:parameters of HOG

Keypoint detection using HOG descriptor

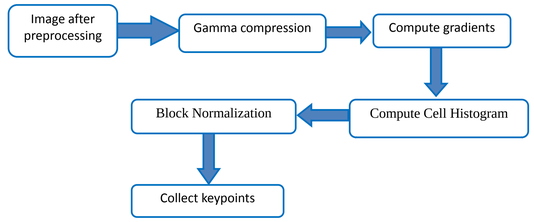


Figure 3: Methodology for HOG

➢ After got the keypoints, we want to classify them using SVM classifier. For do that we want to divide the dataset 70% as training data and 30% as testing data

➢Then again we want to split the 70% of training data as new training data and 30% of training data as validation data.

➢We want to train the system using new training data and test with validation data. Through doing this steps we can get appropriate optc for each classes.

➢Using this opt c, we can classify the testing data.

SVM

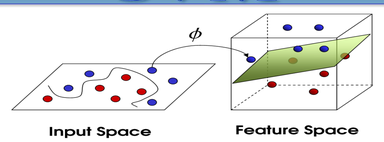


Figure 4: concept of SVM

By comparing the original label and predicted label we can calculate the performance using given equation

Accuracy= (Tp+ Tn)/ (Tp+ Tn+ Fp+ Fn)

Where:

		Predicted class	
		True	False
Actual class	True	True positive(Tp)	False Positive(Fp)
	False	False negative(Fn)	True Negative(Tn)

Dataset

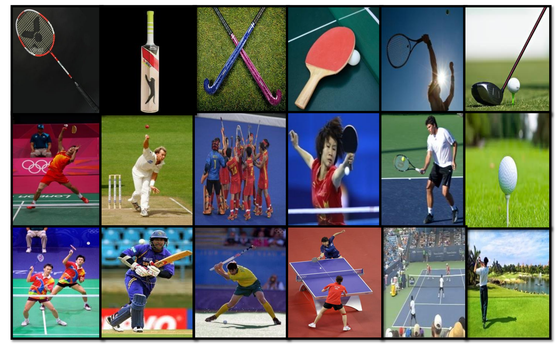
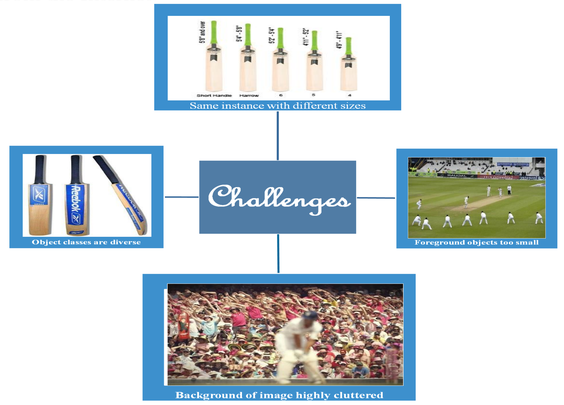


Figure 5: Dataset image types: Badminton, Cricket, Hockey, Table tennis, Tennis, Golf

As the first attempt to tackle the problem of static event recognition (bat-based game detection), we have no existing dataset to use and compare with. We have compiled a new dataset containing six bat-based event categories collected from the Internet.



Results

In this study, we have used of 625 images. Hereby 438 images for training and 187 images for testing the system. Table 1 shows the Accuracy of correctly classified by our method

Table 1 Testing results

Dataset	No.of Training data	No.of Test data	optC ($\times 10^{-3}$)	Accuracy (%)
badminton	70	30	0.49	83.96
cricket	119	51	1.95	72.73
Golf	74	31	0.49	85.56
Hockey	63	27	3.91	84.50
Table Tennis	70	30	7.81	90.37
Tennis	42	18	0.49	83.42

Discussion & Conclusion

❖In this work, we propose a system that learns identify and label to sport games' images. This is achieved by using HOG and linear SVM with an average accuracy of 83.42%.

❖ Our system identified all the game with the accuracy more than 80 except cricket as the clarity of the equipment(such as bat ball and stump) in cricket is much less than the rest.

❖Commercial search engines, large digital image libraries personal albums and other domains can get benefit from more human-like labeling of images.

Reference

[1].Dalal, N. and Triggs, B. "Histograms of Oriented Gradients for Human Detection." *IEEE Computer Society Conference on Computer Vision and Pattern Recognition*, 2005 .

[2].Cortes, Corinna, and Vladimir Vapnik. "Support-vector networks." *Machine learning*, pp. 273-297, 1995.

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[4].Li, Li-Jia, and Li Fei-Fei. "What, where and who? classifying events by scene and object recognition." *IEEE 11th International Conference on Computer Vision*, 2007.