# Comparative Study on Segmentation of Image using Support Vector Machine

**R. Cheryal Percy ,**
**Assistant Professor, Department of Computer Applications, Valliammal College for Women, Chennai– 600102**

## Introduction:

Segmentation is known as a process of partitioning an images space into some non overlapping meaningful homogeneous parts. The remotely sensed images can be classified by using segmentation depends on gray level thresholding and pixel classification. This article describes pixel classification algorithm based on support vector machine algorithm.

**Support Vector Machine:**

Support Vector Machine is a learning architecture that performs structural risk minimization. When a training set data is given the SVM obtains optimal separating hyper plane.

Algorithm:

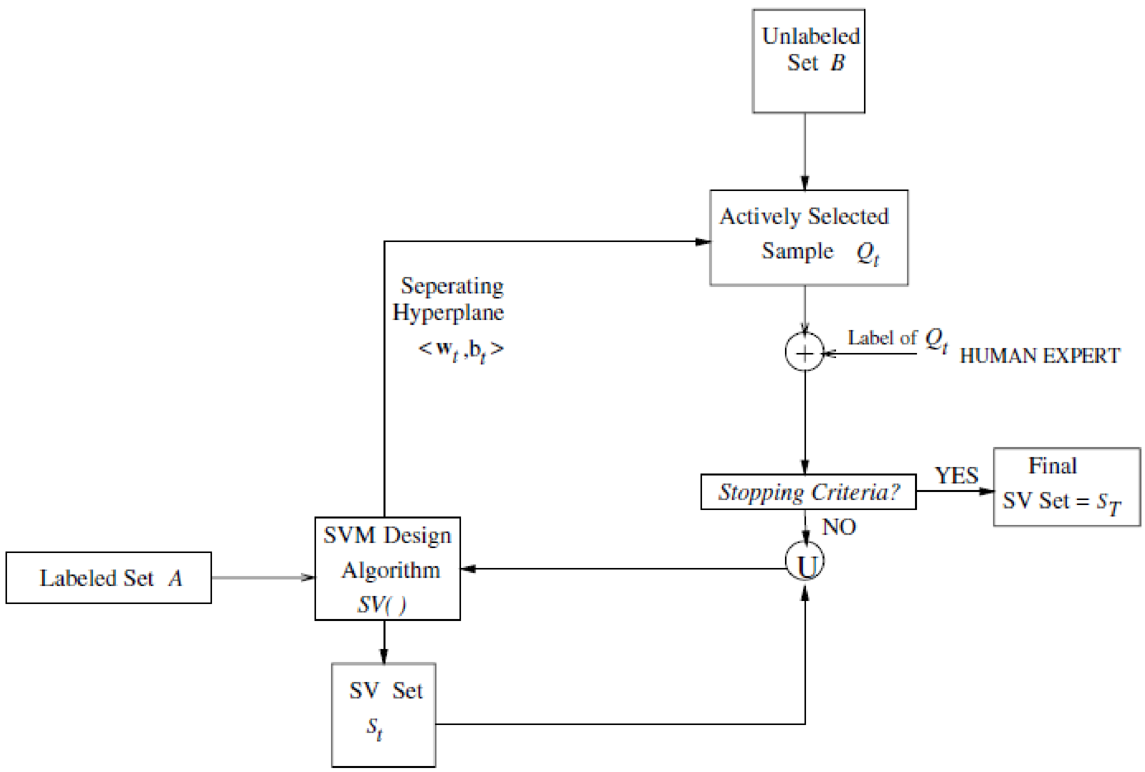
When we are given a set of examples $(\boldsymbol{x}_1, y_1), \ldots, (\boldsymbol{x}_l, y_l), \quad \boldsymbol{x} \in R^N, \quad y_i \in \{-1, +1\}$.

The support vector for minimizing the errors consists of

$$\text{Minimize:} \quad \Phi(\boldsymbol{w}, \xi) = (\boldsymbol{w} \cdot \boldsymbol{w}) + C \sum_{i=1}^{l} \xi_i,$$

**Support Vector Learning for pixel classification:**

The limitations of Support Vetor Machine algorithm describes the need to solve a quadratic programming involving l*l matrix, where l is the number of points in the given data set,the SVM algorithm used here for pixel classification is based on aforesaid principle. The steps are to be repeated k times for k-class problem.




Block diagram of SVM for pixel classification

**Experimental comparison:**

The multispectral image data, which is used experiment, contains observations of the Indian Remote Sensing (IRS) satellite for the city of Mumbai, India. This data contains images of four spectral bands, namely blue, green, red and infrared. The images contains 512 · 512 pixels and each

pixel represents a 36.25 m· 36.25 m region.The task is to segment the image into different

Land cover regions, using the four features(spectral bands). The image consists of six classes e.g., clear water (ponds), turbid water (sea),

concrete (buildings, roads, airport tarmacs), habitation

(concrete structures but less in density),vegetation (crop, forest areas) and open spaces(barren land, playgrounds). The labeled set (A) contains 198 points is initially used.

**Algorithms compared:**

The performance level of the active support vector learning algorithm (active SVM) is compared with the multispectral image segmentation algorithms. Among them, methods SVM 1and SVM 2 represents extreme conditions on the use of labeled data samples. In SVM 1the labeled set is very small in size but the labels are accurate,

while in SVM 2 a large fraction of the entire data constitutes the labeled set, but the labels may be inaccurate. The k-means algorithm is a completely unsupervised scheme requiring no class labels.

(i) SVM 1: the conventional support vector machine,using only the initial labeled set as the entire design set.

(ii) k-means: It is the unsupervised

k-means clustering algorithm.

(iii) SVM 2: the conventional support vector machine,using 10% of the entire set of pixels as the design set. The labels are supplied by the output of the k-means algorithm.

**Conclusion:**

This algorithm uses an initial data set of small numbers from a labeled pixels to design a crude classifier, which is subsequently refined by using excessive number of points obtained by using querying from a pool of unlabeled pixels.

The major goal of the active learning algorithm is to minimize the requirement of labeled pixels. Hence, we adopt aggressive query strategy. However, the aggressive strategy is sensitive to wrong labeling by a experts, thus resulting in performance degradation. In some application, a higher number labeled pixels, with few wrong labels, are available, and more conservative query strategy will provide for better performance.

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