

CMSMD Toolbox User Manual

Circular Mesh based Shape and Margin Descriptor (CMSMD) Toolbox is a shape and margin descriptor toolbox generated for object detection and classification. The key feature of CMSMD is that it can extract the significant properties of both structural, global contour-based characteristics and can function as a combined shape and margin descriptor. The descriptor is compact, has low computational complexity and high efficiency, and can be used in various applications.

Installation

This toolbox works in Matlab 2018a (>>) or higher version and it should be installed before running the CMSMD toolbox.

Usage

The main procedure of the toolbox is written in the CMSMD.m file. The libraries used in the software are explained in detail in the paper. These procedures include steps like pre-processing, segmentation and boundary extraction according to the type of image data before giving it as input to the toolbox. These boundary extracted images are used for the dynamic generation of circular mesh. An interface is created here for ease of access of the Object Classification which includes steps like Circular mesh generation, boundary embedding, CMSMD representation, description, feature extraction and classification. The performance of the system is evaluated using Breast DCE-MRI images.

User Manual

The CMSMD Toolbox is created to perform three main functionalities and they are Training, Testing and Performance Evaluation. The training window opens a dialogue box, by clicking the SELECT CLASS button. The dataset should be saved and selected in a number of folders based on the number of classes. After selecting a particular class, click 'Open' on the dialogue box, then a new text box will appear on the window, and fill the text box with appropriate class name. By pressing the AUTO TRAIN functionality in TRAINING, trains the dataset for a particular class. In our example we have two classes, 'Benign' and 'Malignant'. After completion of training, a message 'Training Completed' will appear on the screen and the next procedure is Testing.

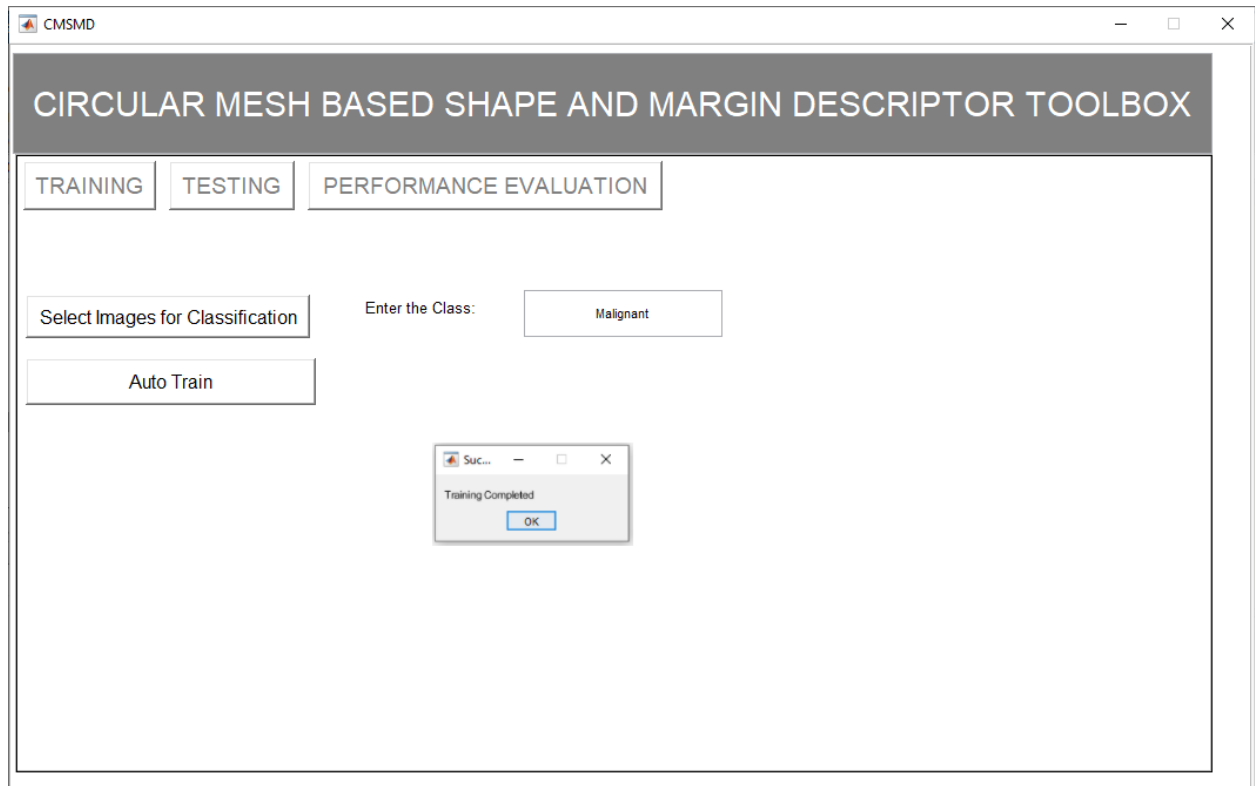


Fig 1: Interface for Training the dataset

The functionality Testing can be performed by clicking TESTING on the interface. This can be achieved either by doing a series of steps BROWSE IMAGE, CIRCULAR MESH GENERATION, BOUNDARY EMBEDDING, CMSMD REPRESENTATION AND DESCRIPTION, FEATURE EXTRACTION, and CLASSIFICATION displayed on the interface or by clicking AUTO TEST. These five procedures are explained in detail in section 2. Software Description of the Circular mesh-based shape and margin descriptor for object detection paper published in the Elsevier Journal under Pattern Recognition. Choose the boundary extracted image object for classification by clicking on BROWSE IMAGE. By clicking on the CIRCULAR MESH GENERATION, a circular mesh will be dynamically generated with $m \times n$ tracks and sectors, based on the irregularity of the boundary image. The third functionality in this series is 'BOUNDARY EMBEDDING' and by clicking on this, the object boundary will be embedded onto the circular mesh. Fig.2 shows Boundary Embedded functionality for a malignant object in the interface.

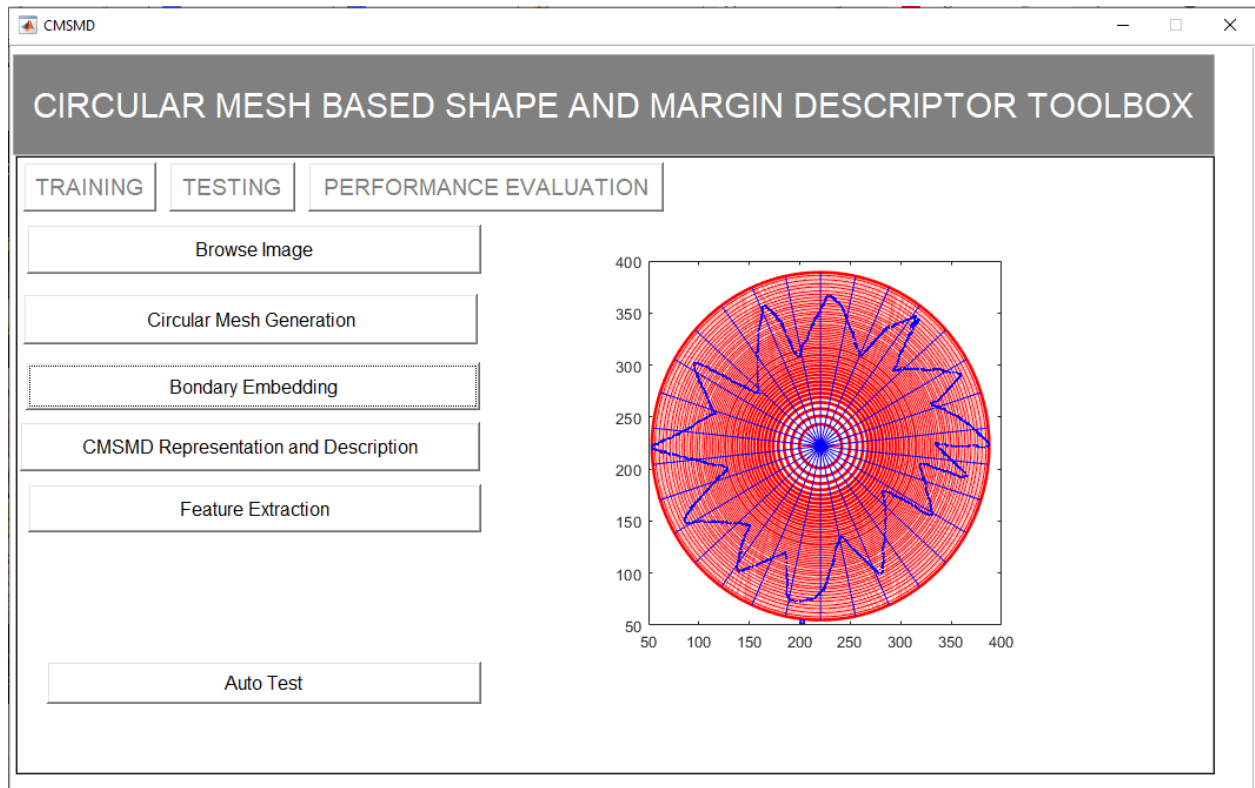


Fig 2: Interface for Testing(Boundary Embedding)

The representation and description of the embedded image using the Circular Mesh-based Cell Labelling(CBL) technique is done by clicking the CMSMD REPRESENTATION AND DESCRIPTION button. The labeled values are stored in two circular arrays, Trk (i) and Sec (i), which will be displayed on the table provided in the window as shown in Fig.3.

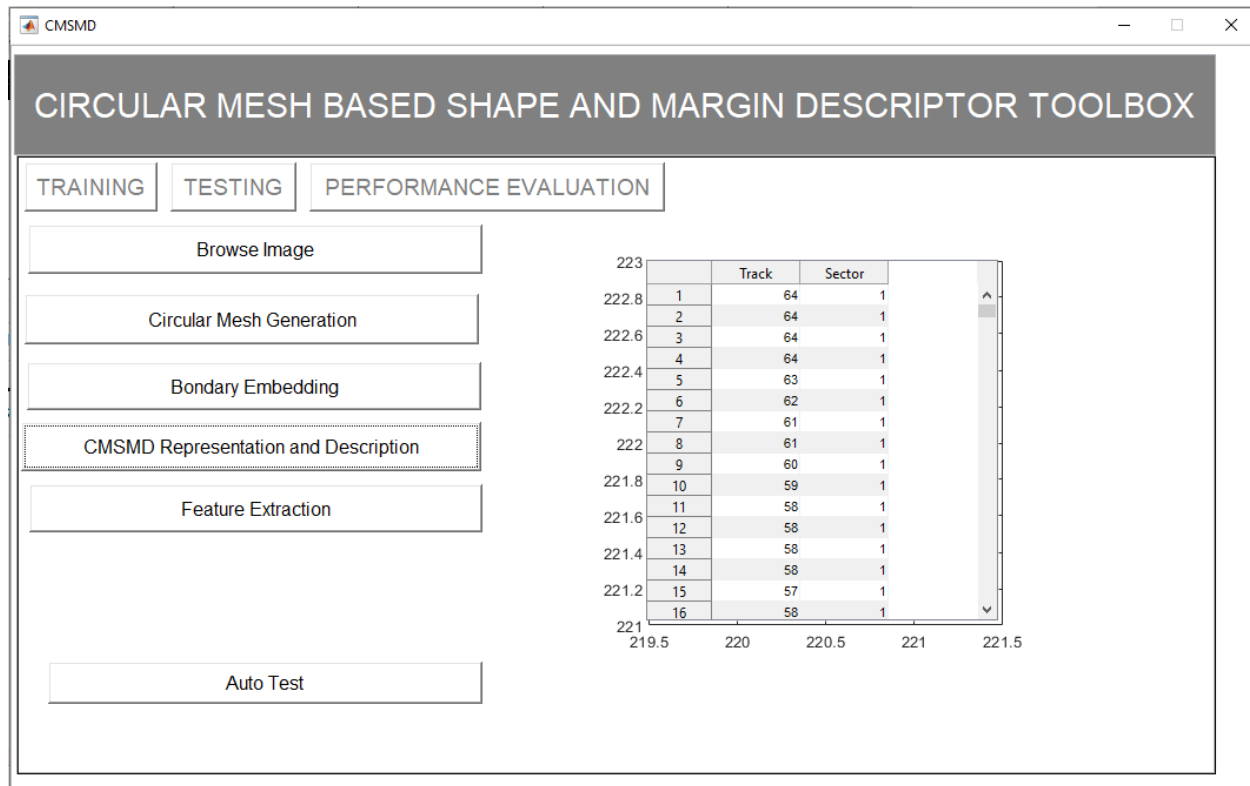


Fig 3: Interface for Testing- CMSMD Representation and Description

The next functionality, FEATURE EXTRACTION extracts the twenty-one relevant features from the CMSMD description. which can be given to the classifier for classification. The space provided in the interface showcases the generated features. The classification of the newly entered object will be done and displays the result on the text box provided by clicking CLASSIFICATION.

All the above-mentioned functionalities can also be executed in a single click AUTO TEST, which gives the classified result through a single click. Fig .4 shows the interface for AUTO TEST.

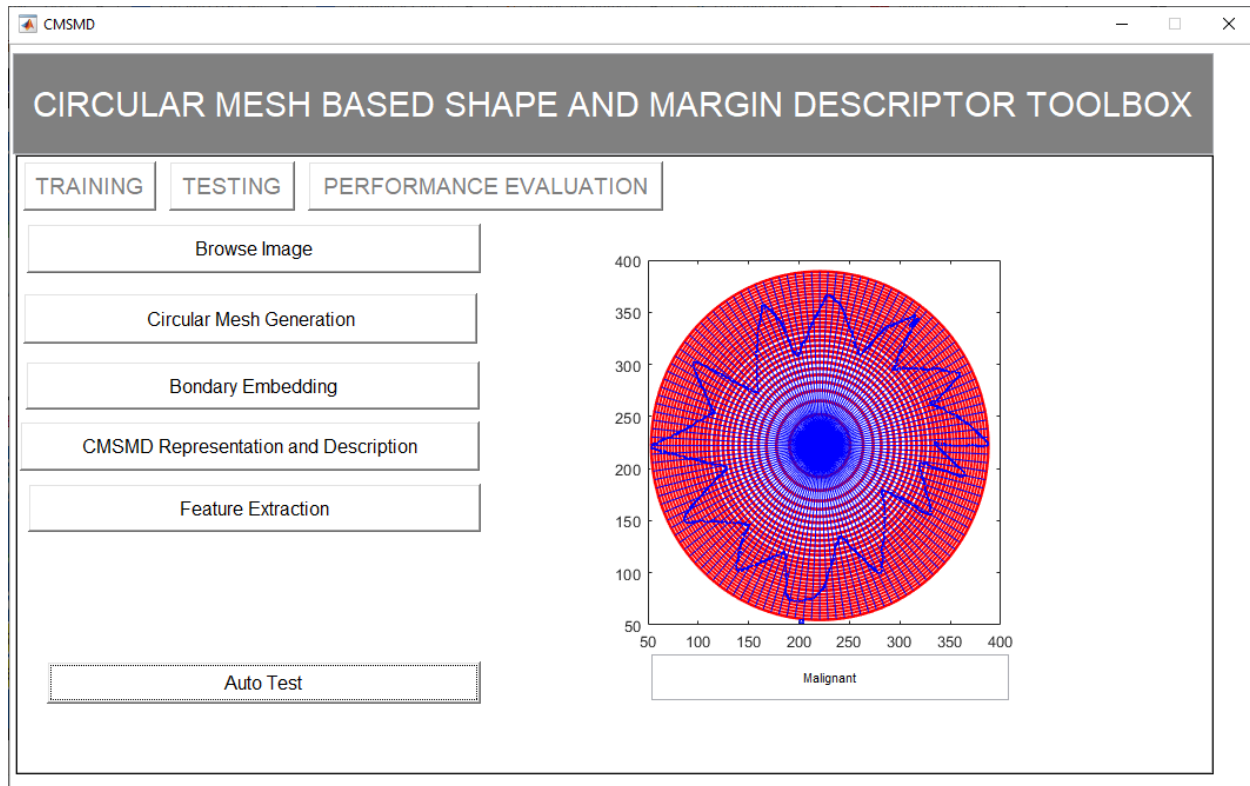


Fig 4: Interface for Testing - Auto Test

The third functionality of the toolbox is PERFORMANCE EVALUATION. The accuracy, sensitivity, specificity, and error rate can be calculated by clicking ACCURACY, SENSITIVITY, SPECIFICITY, and ERROR RATE respectively. Fig.5 shows the interface for Performance Evaluation.

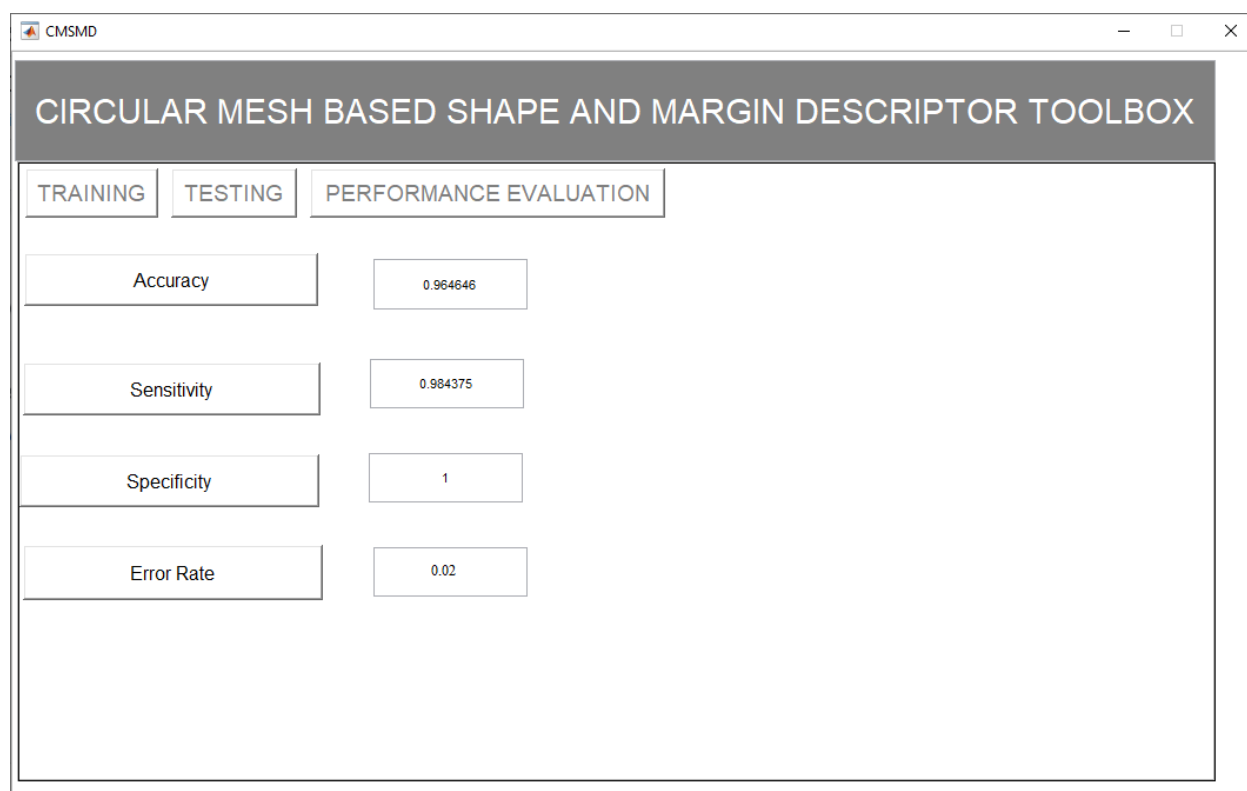


Fig 5: Interface for Performance Evaluation