

# Principles of Biosignals and Biomedical Imaging

1<sup>st</sup> Cycle in Biomedical Engineering —  $P_3$ , 2<sup>nd</sup> Semester 2022/2023

## MATLAB Project - Image Processing of Dermoscopic Images

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Consider the dataset of 10 dermoscopic images present in the `Data` folder, shown in Fig. 1. It is known *a priori* that 5 images correspond to keratosis-like lesions (benign), and the other 5 to melanomas (malignant).

**BACKGROUND:** Survey the biological background related to types of skin cancer, in particular keratosis-like lesions and melanomas.

**STATE-OF-THE-ART:** Investigate in terms of image processing how dermoscopy images are analyzed in computer-aided diagnosis of skin lesions.

**METHODS:** Implement a classic image processing pipeline to classify each image, separating the two aforementioned types of cancer. Follow these steps:

- 1) **Dataset:** Use `imageDatastore` and `readall` to import all the `.jpg` images from your working directory. Convert the images to grayscale and invert them.
- 2) **Denoising:** Remove the noise of these images using a Gaussian filter.
- 3) **Thresholding:** Obtain binary masks using thresholding methods (e.g. Otsu) to separate the background (skin, black) from the foreground (lesion, white).
- 4) **Morphological Operations:** Clean the pre-processed masks by performing binary dilation, border clearing, small object removal and hole-filling within the lesion masks if needed.
- 5) **Feature Extraction:** Multiply the grayscale and inverted images from step 1) with the final binary masks obtained from step 4). Compute the standard deviation of the intensity distribution of each lesion and use `regionprops` to obtain the circularity of each mask.
- 6) **Data Visualization and Analysis:** Perform *k*-means clustering to automatically separate the two classes (benign / malignant lesions). Use `scatter` to plot both features simultaneously in the 2D feature plane along with the corresponding estimated class label.

**RESULTS:** Discuss which data points / clusters correspond to lesions classified as benign (keratosis-like lesions) or malignant (melanomas) according to your research.

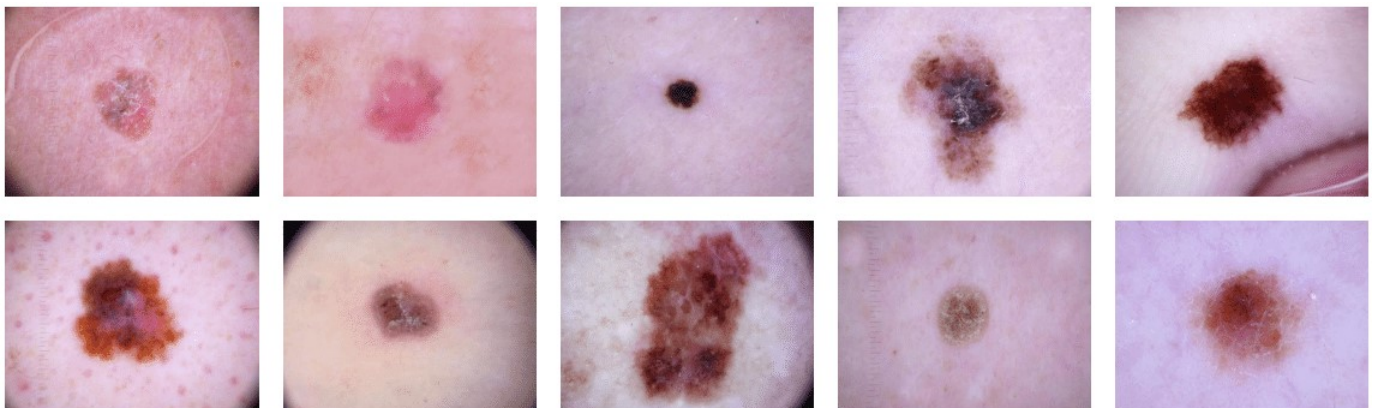


Fig. 1: Dataset with 10 dermoscopic images.