Supervised Learning for Acne Detection & Progression Classification

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Problem description

Acne is a dermalogical problem that affects many people[1]. characterized by tender bumps on the skin, it can be a symptom of other underlining health problems and may require treatment. As a result, tracking the progression of the condition becomes important in the treating process. However, manualy tracking the condition can be tedious and unreliable[2]. In recent years, machine learning techniques have been applied to this problem to help dermatologists. In this report, supervised learning is considered as a method to track acne progression by applying classification techniques to digital images obtained using a mobile application. This will assist with tracking at home treatments.

Formulating the problem in the context of supervised learning

The application will be required to take in an image and seperate it into grids. For each grid, the classifier will need to state if acne is present or not and to what degree (the number of bumps identified and the type of each). The procedure for the application is thus:

1. Block out non-skin pixels
2. Segment image into grids.
3. For each grid, apply spot detection.
4. For each spot classify type
5. Count total spots

Since spot detection in images is a well established task[3] and skin-detection has produced promising insights[4], the spot classification will be the step under investigation.

As features to determine the classification of a bump in an image, I will consider the bump color, grid-average color and bump diameter.

For simplicity, the bump will be classified as a white head, black head or scar.

The goal of this investigation is to thus estimate the function

$$h(x^{(n)}) = y^{(n)} \tag{1}$$

where

$$x^{(n)} = \begin{bmatrix} x_1^{(n)} \\ x_2^{(n)} \\ x_3^{(n)} \end{bmatrix} = \begin{bmatrix} n^{(th)}bumpcolor \\ n^{(th)}grid - averagecolor \\ n^{(th)}bumpdiameter \end{bmatrix} \tag{2}$$

and

$$y^{(n)} = n_{th}bumpclassification \tag{3}$$

References

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