**Abstract**

Our work relates to the problem of classification of Human Epithelial (HEp-2) cells.

We introduce a new efficient texture-based image descriptor for HEp-2 images and compare it with LBP, Haralick features (GLCM statistics) and Tamura features using the public MIVIA HEp-2 Images Dataset.

Proposed descriptor outperforms all previously mentioned approaches and the kNN classifier based solely on this descriptor achieves the accuracy as high as 91.1%.

**1. Motivation**

- The Human Epithelial (HEp-2) cells ... used in the Indirect Immunofluorescence (IIF) tests to detect autoimmune diseases.

The evaluation of IIF tests

- looking for specific fluorescent staining patterns in the cells,
- done by humans,
- subjective method too dependent on the experience of the physician.

- The patterns ... a set of pixels with different distribution.

We introduce ... a novel texture-based descriptor

- very efficient in particular problem of HEp-2 cells images recognition,
- outperform the current state-of-the-art approaches.

**3. Idea of slope processing**

- Extract all slopes from all collinear lines for a particular direction.
- A union of all slopes of all considered directions.
- The function mapping the set of all slopes to the real numbers.

Examples of slope characteristic functions:

- \( \Phi(s) = n \) computes the length of the slope,
- \( \Phi(\omega) = |\Phi(s)| \) computes the height difference between the highest and the lowest point of the slope.

**4. Dataset and evaluation**

- All the experiments on the HEp-2 dataset [1], which contains 1455 cell images of 8 classes (see Figure 3).

We used k-NN classifier implemented using MESSIF framework [2].

- Leave-one-out cross-validation.
- L1 metric as a distance function.

**5. Results**

The performance of proposed descriptor compared with the state-of-the-art descriptors, namely:

- LBP
- Haralick features
- Tamura features.

Table 1 ... the classification accuracy for different numbers of NN.

**Figure 1:** Examples of the surface images for centromere cell (left image) and nucleolar cell (right image).

**Figure 2:** The illustration of continuous 1D signal obtained by traversing the image along the straight line. Each leg between local extremes is denoted as slope and is depicted with different line style: \( h_1, h_2, h_3 \) denotes values of some property for slopes \( 1, 2, 3 \) respectively. In this case, the height of the slope is computed.

**Figure 3:** Examples of examined HEp-2 cell classes.

**Figure 4:** Distance distribution for rotated images (left-hand side box) and intra-class distance distribution (right-hand side box) for each of the 6 classes.

**References**


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