AUTOMATION OF CYTOTOXICITY TESTS USING A HIERARCHICAL IMAGE PARTITIONING

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Aim: Information on cytotoxic effects is still obtained by subjective visual inspection of microscopic samples. Digital image processing must be parameterized manually to cope with different cell lines or microscopic settings. We present a novel concept for a general image partitioning that is automatically applicable to any kind of microscopic images.
Methods: Digital images are decomposed hierarchically. The actual image is regarded as the lowest level of partitioning, where each picture element (pixel) corresponds to a self standing region. Adjacencies are defined using the 4-neighborhood. Similarity of neighbored regions is assessed by their mean gray value and texture. Iteratively, the regions are merged and the graph description is updated. In each step, the convex closure is computed for the largest distance to be merged. The iterative process stops when the entire image corresponds to only one region remaining. Once the hierarchical partitioning is obtained, cells can be located on different scales.
Results: Automatic image decomposition was applied to a variety of cytological samples such as L929 fibroblasts used for cytotoxicity tests. The procedure is robust against illumination differences, varying numbers of cells captured, and whether contacting cells exist.
Conclusion: The proposed method is suitable for automatic measurements in cytological samples. Assessment of biocompatibility is enabled using large microscopic sample sizes but avoiding erroneous and time consuming manual interaction.