Abstract: A Database and Neural Network for Highly Accurate Classification of Single Bone Marrow Cells

Christian Matek[1,2], Sebastian Krappe[3,4], Christian Münzenmayer[3], Torsten Haferlach[5], Carsten Marr[1]

[1]Institute of Computational Biology, Helmholtz Zentrum München, Munich, Germany
[2]Department of Internal Medicine III, University Hospital Munich, Ludwig-Maximilians-Universität München, Munich, Germany
[3]Image Processing and Medical Engineering Department, Fraunhofer Institute for Integrated Circuits IIS, Erlangen, Germany
[4]Department of Computer Science, University of Koblenz-Landau, Koblenz, Germany
[5]MLL Munich Leukemia Laboratory, Munich, Germany
christian.matek@helmholtz-muenchen.de

Fast and accurate morphological classification of cells in bone marrow samples is a key step in the diagnostic workup of many disorders of the hematopoietic system such as leukemias. In spite of its long-established key position, morphological examination of bone marrow samples has been difficult to automatise, and is still mainly performed manually by trained cytologists on light microscopes. In our contribution [1], we present a neural network for classification of light microscopy images of bone marrow samples. The network was developed using what to the authors' knowledge is the most extensive publically available image dataset of bone marrow cells, containing over 170,000 images from the samples of 945 patients diagnosed with a variety of hematological disorders, reflecting the sample entry of a center specialised in hematological diagnostics [2]. The network is shown to be highly accurate for most key cell classes, outperforming previous approaches in single-cell bone marrow examination. We test different network architectures to show our results are robust with respect to the details of network structure. The results are validated on a smaller, external dataset published previously by Choi et al. [3]. We also analyse the network's predictions using recently developed methods of explainable AI, specifically SmoothGrad and GradCAM. These methods suggest that the network has learned to focus on relevant structural features of the bone marrow cells shown.

References

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