IICBU 2008 – A Benchmark Suite for Biological Imaging

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The increasing availability of machinery for automated biological image acquisition has introduced the need for effective algorithms for biological image analysis and classification. These enabling algorithms are constantly being developed by pattern recognition and machine vision experts, who tailor and adjust general computer vision methods to the specific needs of biological imaging. However, in many real-life cases, machine vision specialists do not have convenient access to biological datasets that can be used for developing and testing their algorithms, or comparing the algorithm performance with a defined baseline. In other cases, computer science experts do not work closely with biologists, who are better able to define the biological problems as well as direct research towards effective and practical solutions.

Here we propose a benchmark suite of biological datasets that can be used by machine vision experts who wish to develop algorithms for biological imaging. This collection represents a set of practical real-life imaging problems in biology, and offers examples of cells, tissues and organisms imaged at different magnifications with different contrast techniques. The datasets are also different in the number of images, size of the images, number of classes, and the degree of similarity between the distinct classes. The datasets included in IICBU-2008 benchmark suite are listed in Table 1.

Dataset	# of classes	# of images	Image format	Microscopy
Pollen	7	630	25x25 8 bit TIFF	Phase contrast
RNAi	10	200	1024x1024 16 bit TIFF	Fluorescence
C. elegans muscle age	4	252	1600x1200 16 bit TIFF	Fluorescence
Terminal bulb aging	7	970	300x300 16 bit TIFF	DIC
Binucleate	2	40	1280x1024 16 bit TIFF	Fluorescence
Lymphoma	3	375	1388x1040 32 bit TIFF (color)	Brightfield
Liver age	18	1500	1388x1040 32 bit TIFF (color)	Brightfield
2D HeLa	10	860	382x382 16 bit TIFF	Fluorescence
CHO	5	340	512x382 16 bit TIFF	Fluorescence

Table 1. Number of classes, number of images, format, size and microscopy of the datasets of IICBU-2008.

Benchmark classification accuracies have been computed in order to provide a rough estimation of the level of difficulty of each problem, and allow scientists to compare their newly developed algorithms with existing performance figures. The classification accuracies of the datasets were measured using the WND-CHARM multi-purpose image classification method (Orlov et al., 2008), which is designed for analyzing a wide range of biological image datasets. The classification accuracy of all datasets is given by Figure 1.

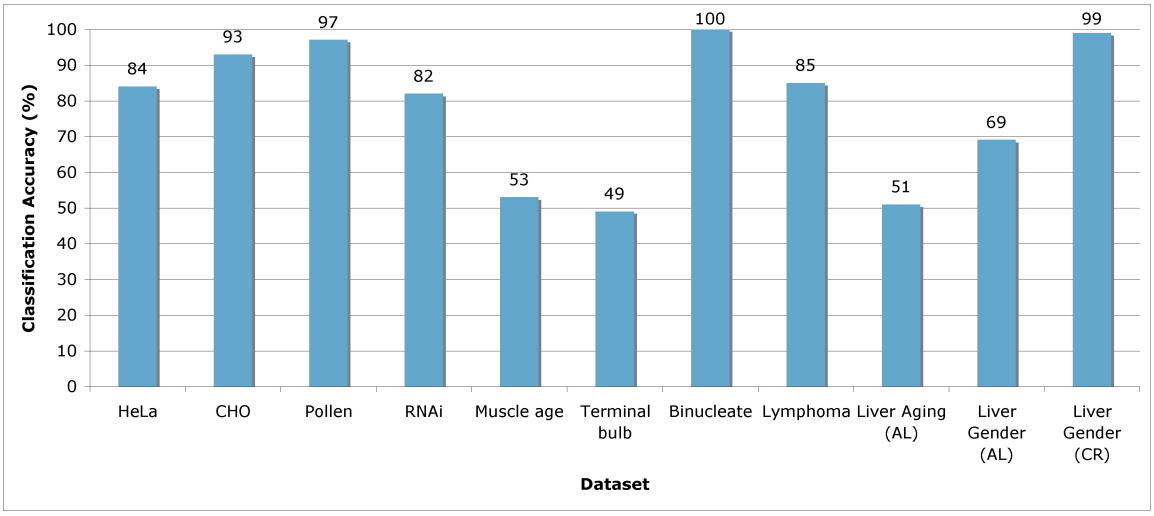

Fig. 1. Classification accuracy of the datasets using WND-CHARM image classification algorithm.

The datasets are available for free download via the world wide web at http://ome.grc.nia.nih.gov/iicbu2008, and no registration or license agreement is required. IICBU-2008 is an on-going venture, and we encourage scientists who own datasets of biological images to contribute their data and make them available to the scientific community through this benchmark suite.

References

Orlov, N., Shamir, L., Macura, T.J., Johnston, J., Goldberg, I.G., "WND-CHARM: Multi purpose image classification using compound transforms", *Pattern Recognition Letters*, submitted.