

Development of an analytical module based on the Omnipose neural network for morphometric analysis of metastatic cancer cells

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INTRODUCTION & AIM

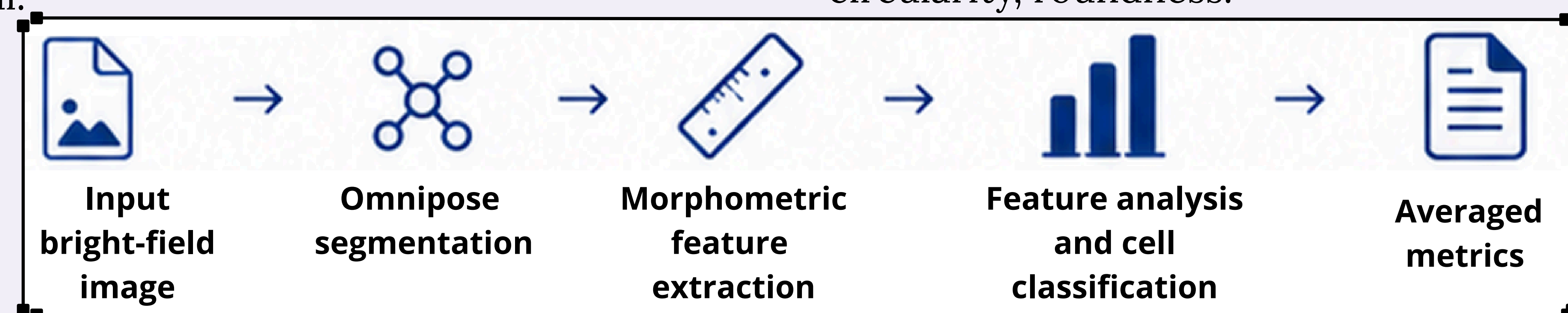
Problem

Cell morphology is strongly correlated with metastatic potential (MP).

Omnipose provides accurate instance segmentation of cells but lacks tools for morphometric quantification and downstream analysis.

Objective

To develop an integrated module that performs complete morphometric analysis of cancer cells on bright-field images and provides quantitative features for estimation of metastatic potential.



METHOD

A custom Python module was integrated into the pre-trained Omnipose model (Cutler et al., 2022) to enable automatic morphometric extraction and analysis.

Data

Bright-field images of breast cancer cells:

- MDA-MB-231 (high metastatic potential)
- MCF-7 (low metastatic potential)

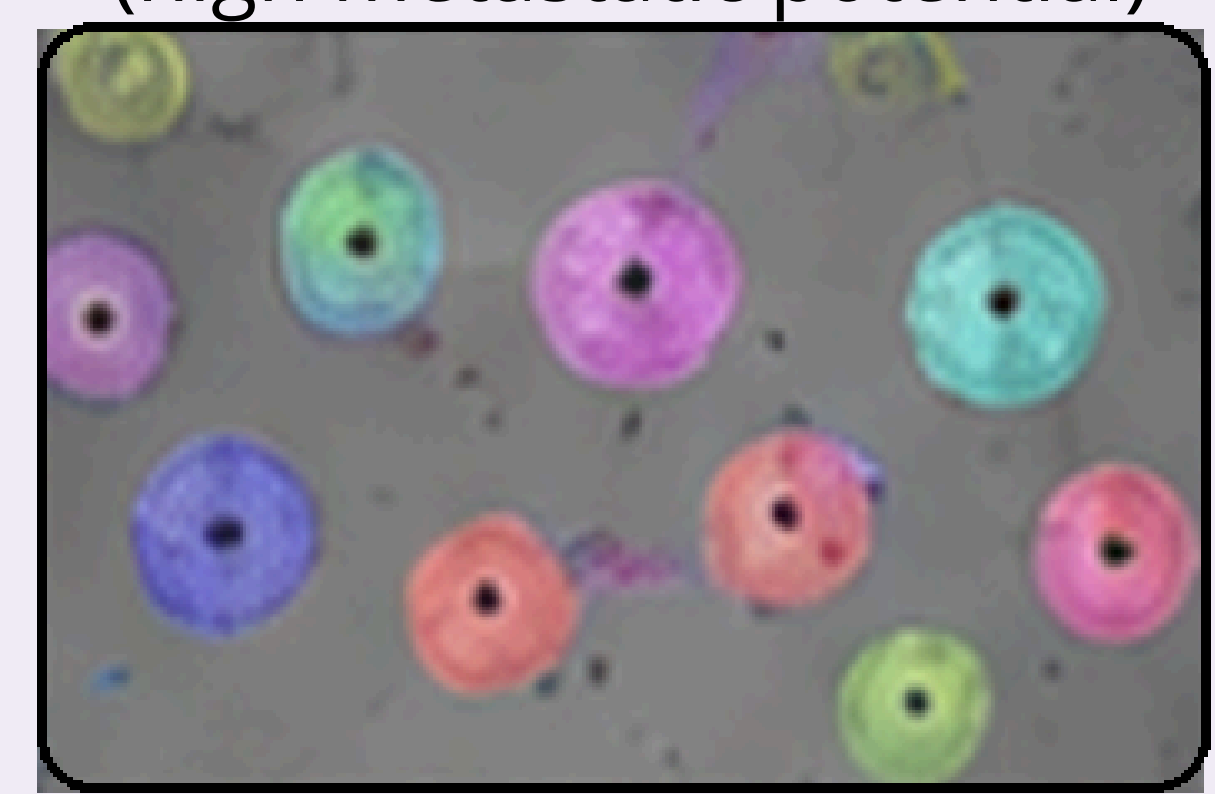
Extracted Morphological Features:

Area, perimeter, major axis, minor axis, circularity, roundness.



MDA-MB-231

(high metastatic potential)

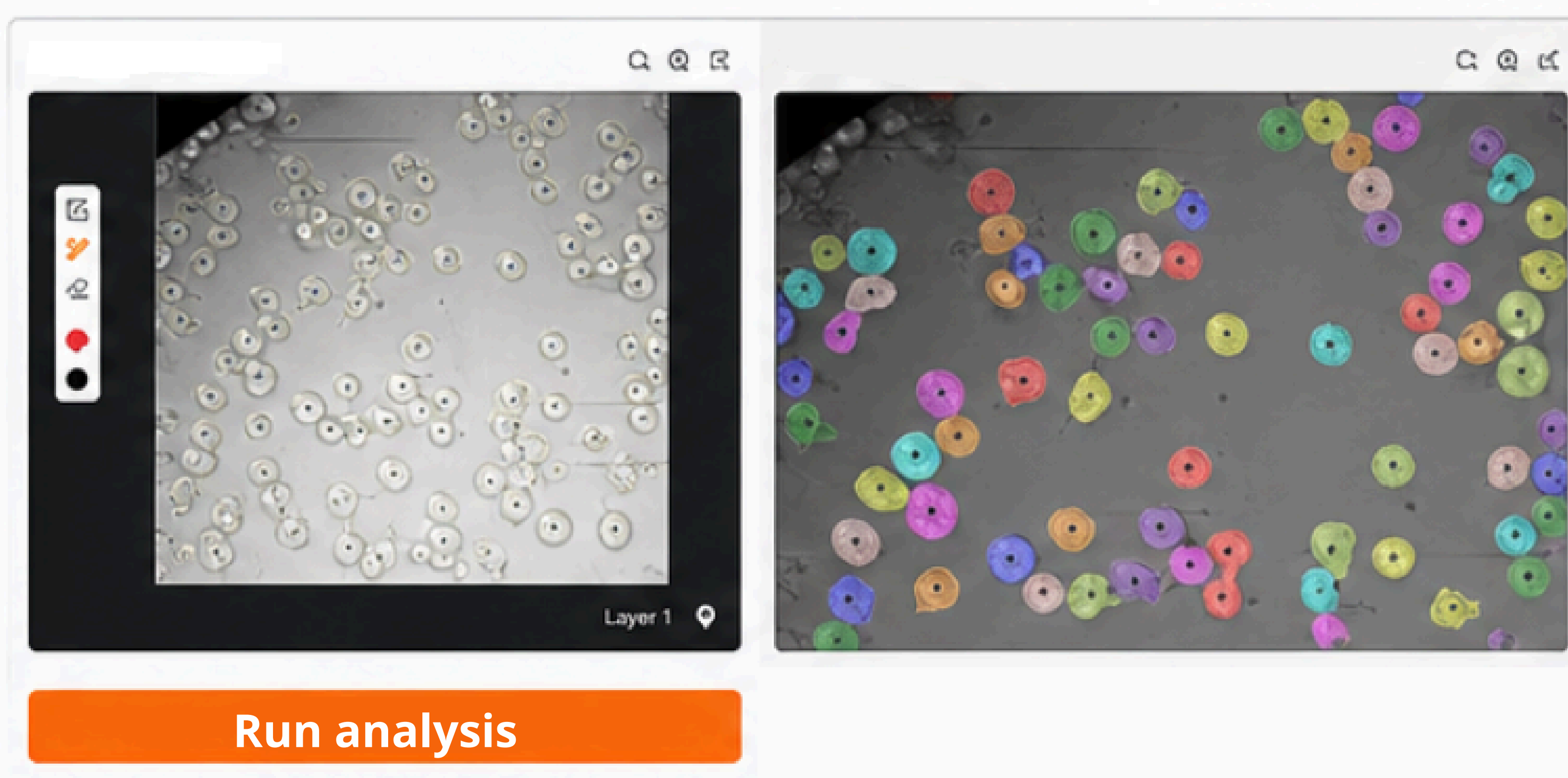


MCF-7

(low metastatic potential)

RESULTS & DISCUSSION

Analytical module "Cell analyser"



The cell recognition accuracy of the Omnipose neural network exceeded 80%, confirming the high reliability of the approach. Morphological features, particularly circularity and aspect ratio, showed clear separation between high-metastatic (MDA-MB-231) and low-metastatic (MCF-7) cell lines.

>80%

Segmentation Accuracy

<5%

Size Parameter Error

<11%

Shape Parameter Deviation

Our results demonstrate that automated morphometric analysis of bright-field images can effectively distinguish cells with different metastatic potential.

CONCLUSIONS

The developed analytical module transforms Omnipose from a simple segmentation tool into a comprehensive platform for direct morphometric analysis of microscopic images without requiring sample pre-processing or staining.

The module provides the foundation for a convenient tool to quantitatively evaluate the metastatic potential of cancer cells, opening up new possibilities for clinical and research applications in experimental oncology.

REFERENCES

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3. Cutler K.J. Omnipose: high-precision cell segmentation for diverse morphologies. GitHub; 2022. Available from: <https://github.com/kevinjohncutler/omnipose> (accessed 17 March 2026).