

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

Metastasis is the main cause of all cancer-related mortality. Cell morphology is strongly correlated with metastatic potential (MP) [3]. 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 [1,2] to enable automatic morphometric extraction and analysis.

Data

Over 65 bright field images of breast cancer cells, with at least 54 cells on every image were evaluated

Extracted Morphological Features: Area, perimeter, major axis, minor axis, circularity, roundness.

RESULTS & DISCUSSION

The cell recognition accuracy of the Omnipose neural network exceeded 80%, confirming the relatively high reliability of the approach. However this accuracy is not enough for metastatic potential definition. The developed analytical module allows manual segmentation modification to achieve 100% accuracy. Up to 20 cell images could be uploaded and evaluated on time.

After analysis, the program displays a table with all the calculated values:

CELL PARAMETERS (total: 79 cells)						
ID	Area	Perimeter	Roundness	Solidity	Major axis len	Minor axis len
0	2243	178	53.4	0.883	61.6	46.8
1	582	105	27.2	0.663	38.5	20.3
2	417	104	23	0.477	45.7	12.0
3	1682	169	46.3	0.737	57.9	39.7
4	2206	180	53	0.848	53.3	48.9
5	2285	175	53.9	0.928	55.0	52.9
6	2098	170	51.7	0.910	54.8	48.9
7	1693	150	46.4	0.944	47.3	45.6
8	1626	149	45.5	0.917	47.5	43.6
9	2162	183	52.5	0.807	63.0	44.7

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.

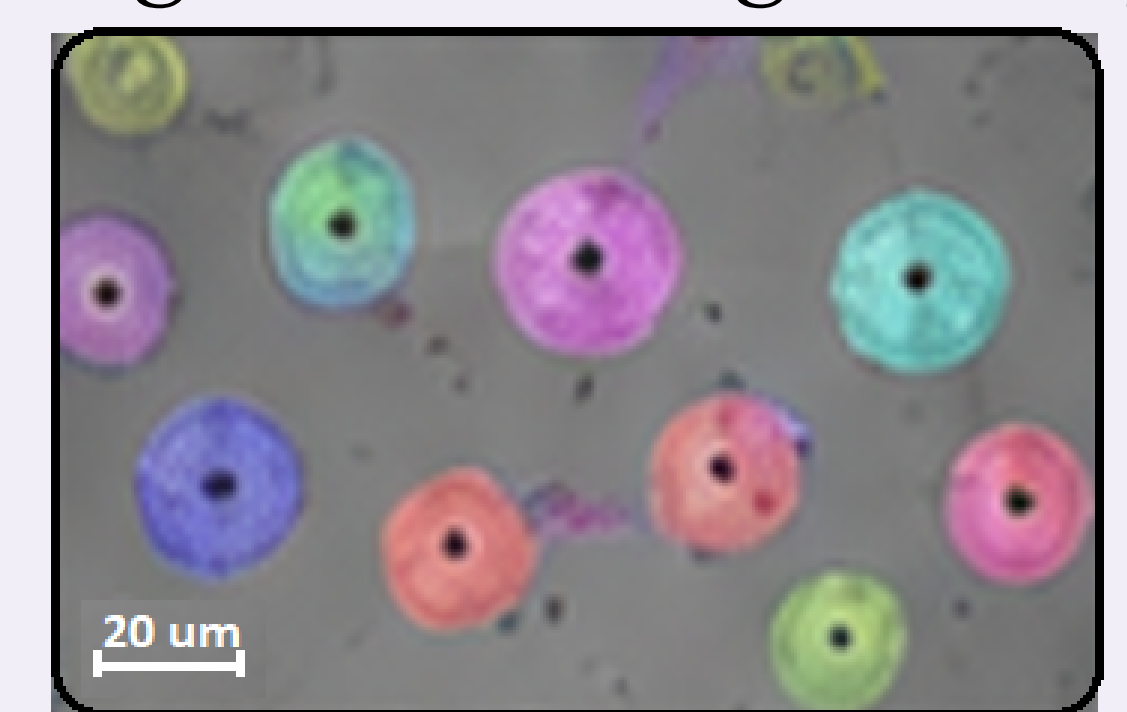
The module provides the foundation for a convenient tool to quantitatively evaluate the metastatic potential of cancer cells, opening up new possibilities for clinical and research applications in experimental oncology.

REFERENCES

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MDA-MB-231
(high metastatic potential)



MCF-7
(low metastatic potential)

>80%

Segmentation
Accuracy

<5%

Size Parameter
Error

<11%

Shape Parameter
Deviation

