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Systematic changes in invasive cancer cell shape¹ ASHOK PRASAD, ELAHEH ALIZADEH, SAMANTHE LYONS, JORDAN CASTLE, JACQUELINE FOSS, JOSHUA MANNHEIMER, Colorado State University — We study the shape characteristics of osteosarcoma cancer cell lines using both Zernike moments and geometric parameters to represent cell shape. We compare the shape characteristics of four invasive cell lines with a corresponding less-invasive parental line on three substrates. Cell shapes of each pair of cell lines display overlapping characteristics. To quantitatively study shape changes in high-dimensional parameter space we define a vector representing average shape changes in principal component space. Using this vector we find that three of the four pairs of cell lines show similar changes in shape, while the fourth pair shows a very different pattern of changes. We find that shape differences are robust enough to enable a neural network to classify cells accurately as belonging to the highly invasive or the less invasive phenotype. The patterns of shape changes were also reproducible for repetitions of the experiment. Shape changes on different substrates as well as after treatment with pharmacological agents also show reproducible patterns. Our paper strongly suggests that shape may provide a means to read out the phenotypic state of at least some cell types, and shape analysis can be usefully performed using a Zernike moment representation.

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