Supplemental figures



FIGURE S1 Classification using a single feature (Otsu-segmented-region area) resulted in a poor confusion matrix. Class names are abbreviated after Fig. 1a. CellCognition dataset was used (see Methods §2.1).



FIGURE S2 Selecting the number of trees in random forests classifier by plotting the out-of-bag error versus the number of trees. The black, blue and red lines depict the average, minimum and maximum out-of-bag errors, respectively, over the 5-fold iterations of the cross-validation. CellCognition dataset was used (see Methods §2.1).



FIGURE S3 Random forests using all the 1025 features was trained and tested over 20% of the dataset to get (a) the confusion matrix and (b) the ROC curves over the 5-fold cross-validation using the CellCognition dataset (see Methods §2.1). Class names are abbreviated after Fig. 1a.



FIGURE S4 Random forests with computationally intensive features optimised by removing low importance feature groups. The algorithm was trained and tested over 20% of the dataset to get (a) the confusion matrix and (b) the ROC curves over the 5-fold cross-validation using the CellCognition dataset (see Methods §2.1). Class names are abbreviated after Fig. 1a.



FIGURE S5 Bootstrapping the random forests optimised with only non-computationally-intensive

feature-groups. (a) The Area Under Curve (AUC) was averaged over the classes, and (b) execution time for extracting the feature-groups included in the classification was assessed. Both quantities are plotted versus the number of feature-groups used in classification and were computed in the 5-fold cross-validation repeats. This approach was repeated 10 times in the bootstrap approach, where the vignettes included in the balanced dataset were selected differently from the CellCognition (see Methods §2.1). We thus obtained the standard deviations reported by the error bars. Fig. 5ab report results in the same conditions for a single bootstrap iteration. Arrowheads depict the 12 feature groups optimal case.



FIGURE S6 Classification using Deep learning. (a) Confusion matrix and (B) corresponding ROC curves, averaged over the 5-fold cross-validation for the classification over the *CellCognition* dataset (see Methods §2.1). Class names are abbreviated after Fig. 1a.



FIGURE S7 Mis-classified images using optimised random forests over Cell cognition. Cell pictures misclassified were reported for the 5-fold cross-validation over the CellCognition dataset (see Methods §2.1). The table mimics the confusion matrix (Fig. 5c). Rows correspond to true classes while columns to predicted classes. Green and blue frames highlight images misclassified to the class just before or after the real one in the order of the cycle or mitotic phases. Purple triangles depict frames where neighbouring cells appear, likely confusing the classifier. Class names are abbreviated after Fig. 1a.