**Computer vision profiling of neurite outgrowth morphodynamic phenotypes**

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**Abstract** (150 words)

Neurite outgrowth is a dynamic cell behavior that consists of morphogenetic processes such as neurite initiation, protrusion-retraction cycles, branching and growth cone navigation. Current knowledge of the underlying signaling events stem from molecular perturbations assessed at the steady state, which cannot capture the dynamic nature of this complex process. Here, we present NeuroDynamics an integrated pipeline to study neurite outgrowth dynamics. A microscopy platform allows for high content imaging of neurite outgrowth dynamics. A computer vision approach allows segmentation of cell shape and extraction of features describing neuronal morphodynamics. Statistical analysis then allows to automatically identify features that significantly discriminate between the control and perturbed state. We demonstrate the applicability of our approach by automatically annotating morphodynamic phenotypes in an RNA interference screen targeting a candidate Rho GTPase signaling network identified by a proteomics approach. NeuroDynamics is freely available as open source software to study neuronal outgrowth dynamics.

* You are welcome to add some technical jargon given that we remain in the 150 words limit !
* We can also think of another acronym than Neurodynamics !

**Figures**

**Figure 1.** Global pipeline to analyze neurite outgrowth morphodynamic phenotypes. (olivier and Ludo)

**Figure 2.** Computer vision segmentation of neuronal morphodynamics feature extraction.

(Fethallah and Kevin)

Basically a scheme that describes the different steps in segmenting of the soma, neurites, ...

**Figure 3.** Description of morphodynamic features.

(Fethallah and Kevin)

basically a scheme that summarizes all the different dynamic features that are extracted

**Figure 4.** Morphodynamic phenotype feature selection

(Riwal)

try to make a series of schemes that explain the different steps in feature selection,

vector distance, assessment of interplate and siRNA induced noise.

**Figure 5.** Morphodynamic phenotype description.

(Riwal, Olivier, Ludo)

this will consist of a color-coded map of the different features extracted for each gene perturbation, we will then focus on more specific aspects of what we learned.

**Supplementary Figures.**

**Figure S1.** Experimental controls for lifeact-GFP fluorescent reporter, experimental control for knockdown efficiency by a selected number of siRNAs. (olivier and Ludo)

**Figure S2.** Comparison of ground truth and computer vision segmented data. (Fethallah and Kevin)

**Figure S3.** Feature selection on synthetic data produced by mixing videos from different known sources to test the ability of the algorithm to appropriately identify different morphodynamic signatures (Riwal)

**Supplementary tables.**

**Table S1.** Definition of features. him