PhenoLearn

Turning Images into Insights

For scientists, computational biologists, and anyone interested in training convolutional neural nets

PhenoLearn: Artificial Intelligence for Cellular and Tissue Analysis

Overview

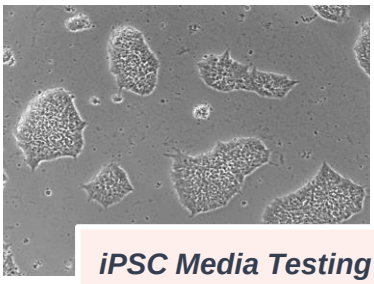
PhenoLearn lets scientists create and deploy highly-accurate and robust models of cellular and tissue phenotypes using the latest techniques in deep learning for image classification and segmentation.

Features

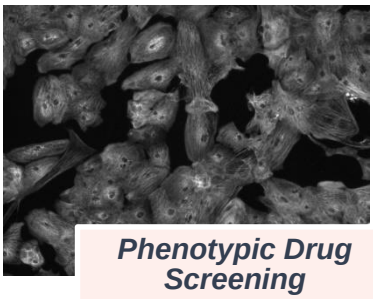
- Works with 2D images captured by any imaging system
- Easy to use with minimal user configuration
- No need to define the features a priori
- Provides objective, consistent, and unbiased results
- Enables scalable and fast deployment

Contents

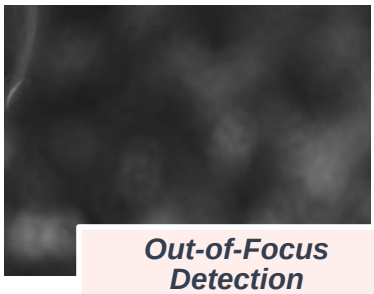
This document presents the following case studies:



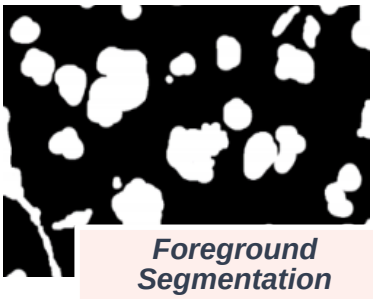
iPSC Media Testing



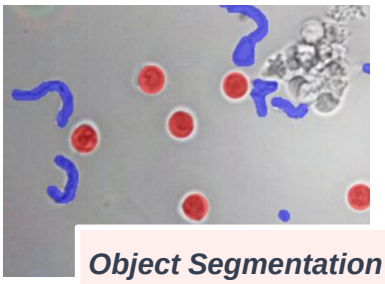
Phenotypic Drug Screening



Out-of-Focus Detection



Foreground Segmentation



Object Segmentation

Case Study: iPSC Media Testing

Goal

To determine if there are differences in morphology between iPSCs cultured in two types of media.

Workflow

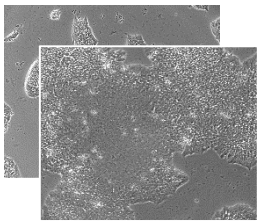
Step 1: Generate Training Data

Collect images of iPSCs cultured in two different media. If desired, use time-lapse to capture different cell densities.

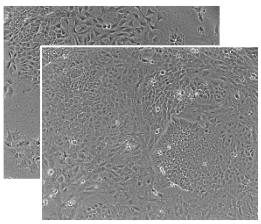
Step 2: Train a Model

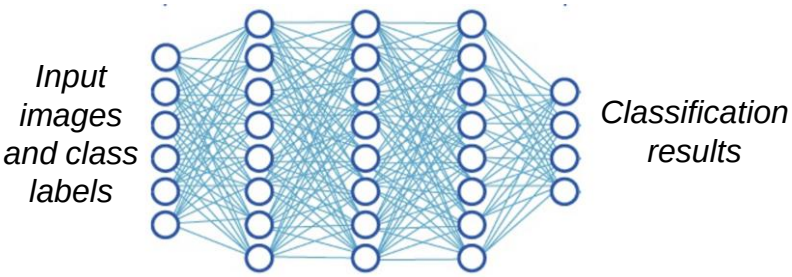
Upload your data to PhenoLearn and submit a new training. The model learns if there is a phenotype.

Media 1:



Media 2:





Deep neural network

Step 3: Evaluate Results

Evaluate the validation accuracy and z-factor to determine the extent of phenotypic differences. In this case, a high validation accuracy, and z-factor close to 1.0, indicates a robust phenotype between iPSCs cultured in Media 1 and 2.

Case Study: Phenotypic Drug Screening

Goal

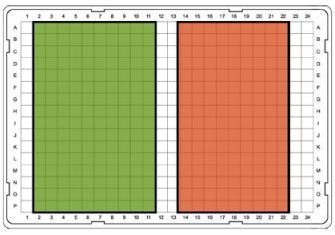
To automatically learn image-based cellular phenotypes for drug testing and high-throughput screening.

Workflow

Step 1: Generate Training Data

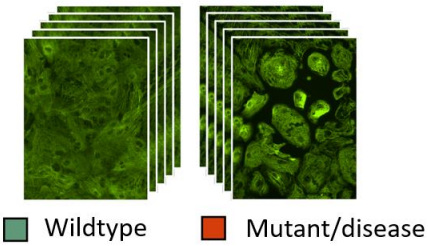
Select cell type and marker, and generate training images for healthy and mutant cells.

Plate layout:



Images:

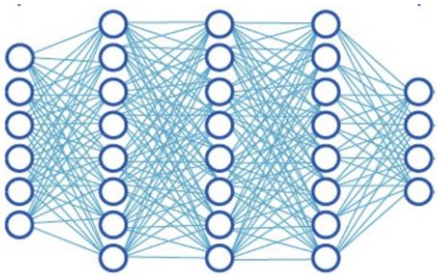
Classes:



Step 2: Train Model

Train a model on PhenoLearn to automatically learn phenotypes for healthy vs. mutant.

Input images and class labels

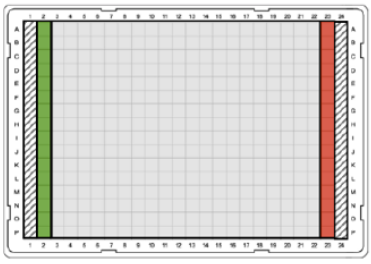


Classification results

Deep neural network

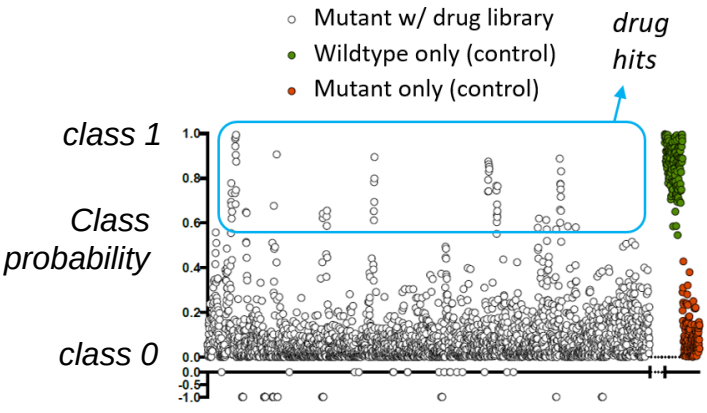
Step 3: Run Experiment

Apply drug library to mutant cells and generate images for testing.



Step 4: Deploy Model

Classify test images with your trained model on PhenoLearn to identify drugs that reverse the mutant phenotype.



Case Study: Out-of-Focus Detection

Goal

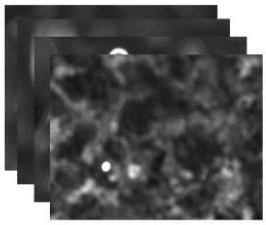
To automatically detect out-of-focus images captured by a high-throughput microscopy system in order to exclude them from further analysis.

Workflow

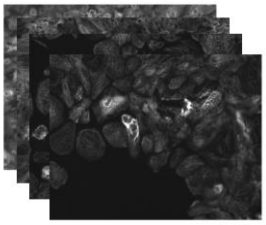
Step 1: Generate Training Data

Gather two sets of images: one in-focus, one out-of-focus, and organize them into separate folders.

Out-of-focus:



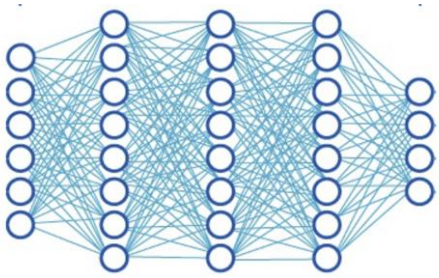
In-focus:



Step 2: Train a Model

Upload your data to PhenoLearn and submit a new training. The model learns how to classify in-focus vs. out-of-focus.

Input images and class labels

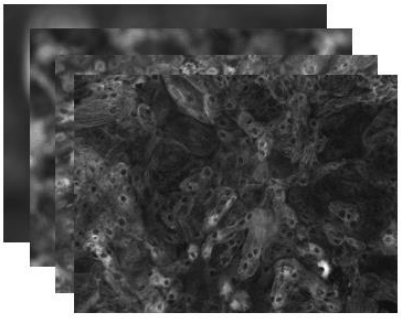


Classification results

Deep neural network

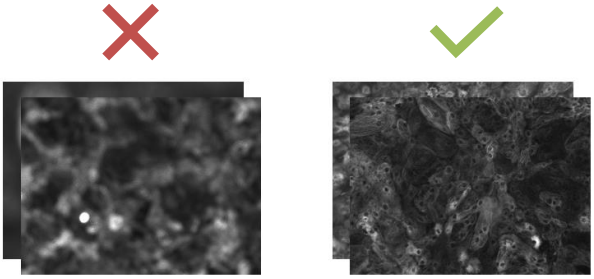
Step 3: Run New Experiment

Perform high-throughput experiment to capture new images.



Step 4: Deploy Model

Classify new images with your trained model on PhenoLearn to automatically reject out-of-focus images.



Case Study: Foreground Segmentation

Goal

To perform robust segmentation of foreground pixels in a microscopy image.

Workflow

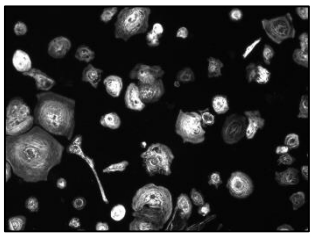
Step 1: Generate Training Data

Capture images and create manual labels of foreground.

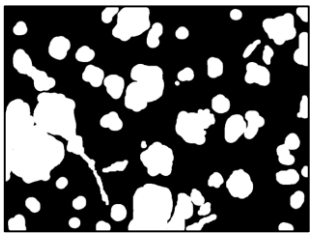
Step 2: Train Model

Train a model on PhenoLearn to automatically learn how to segment foreground pixels.

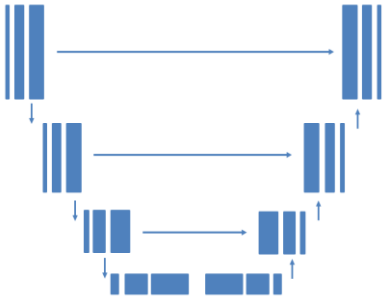
Image:



Manual foreground label:



Input images and manual labels



Segmentation results

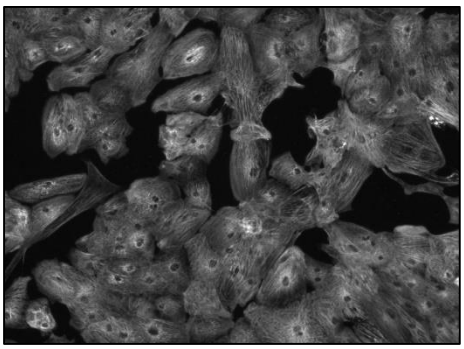
Deep neural network

Step 3: Run Experiment

Capture new images of cells.

Step 4: Deploy Model

Use your trained model on PhenoLearn to automatically segment foreground pixels.



Case Study: Object Segmentation

Goal

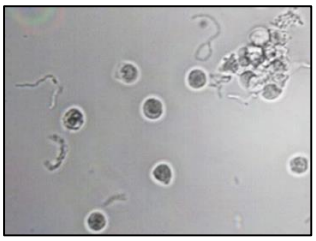
To automatically segment objects-of-interest in a microscopy image, such as white blood cells and bacteria.

Workflow

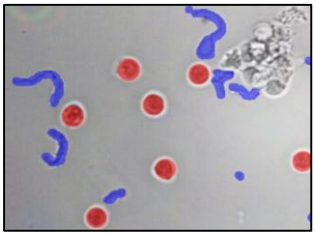
Step 1: Generate Training Data

Capture images and create manual labels of objects of interest.

Image:



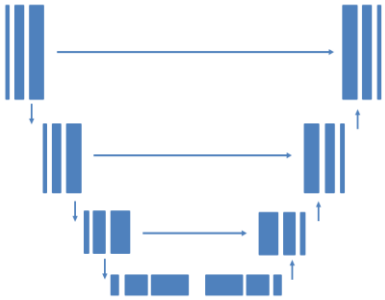
Manually labeled image:



Step 2: Train Model

Train a model to automatically learn how to segment the objects.

Input images and manual labels

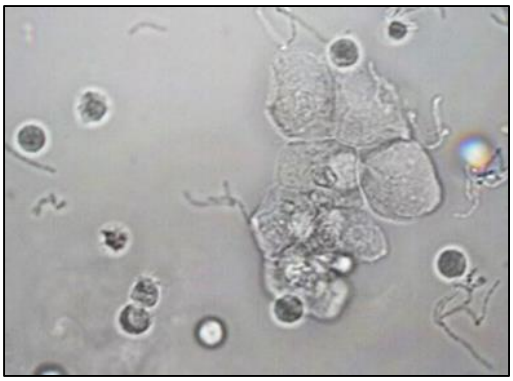


Segmentation results

Deep neural network

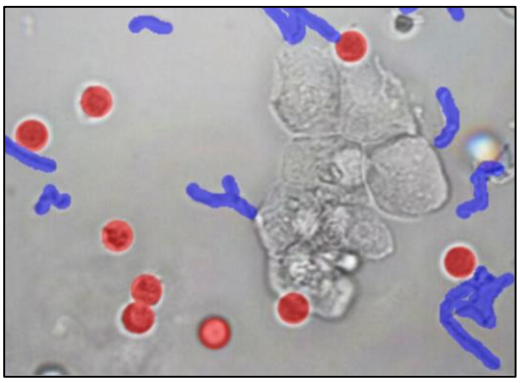
Step 3: Run Experiment

Capture new images.



Step 4: Deploy Model

Use your trained model on PhenoLearn to automatically segment the objects.



PhenoLearn

Contact Information

Dana Solutions LLC
3505 El Camino Real
Palo Alto, CA 94306

Email: danasolutionsllc@gmail.com
Web: www.danasolutionsllc.com