Deep Learning for Mesenchymal Stem Cell Characterization

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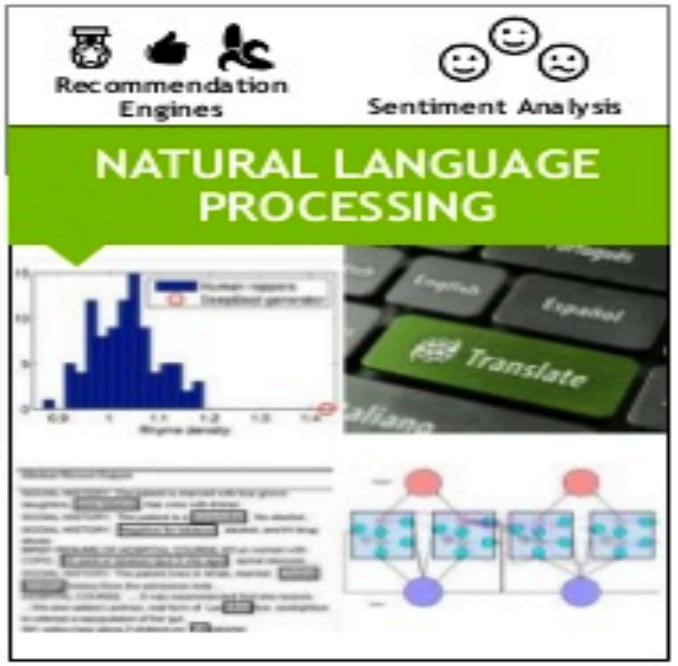
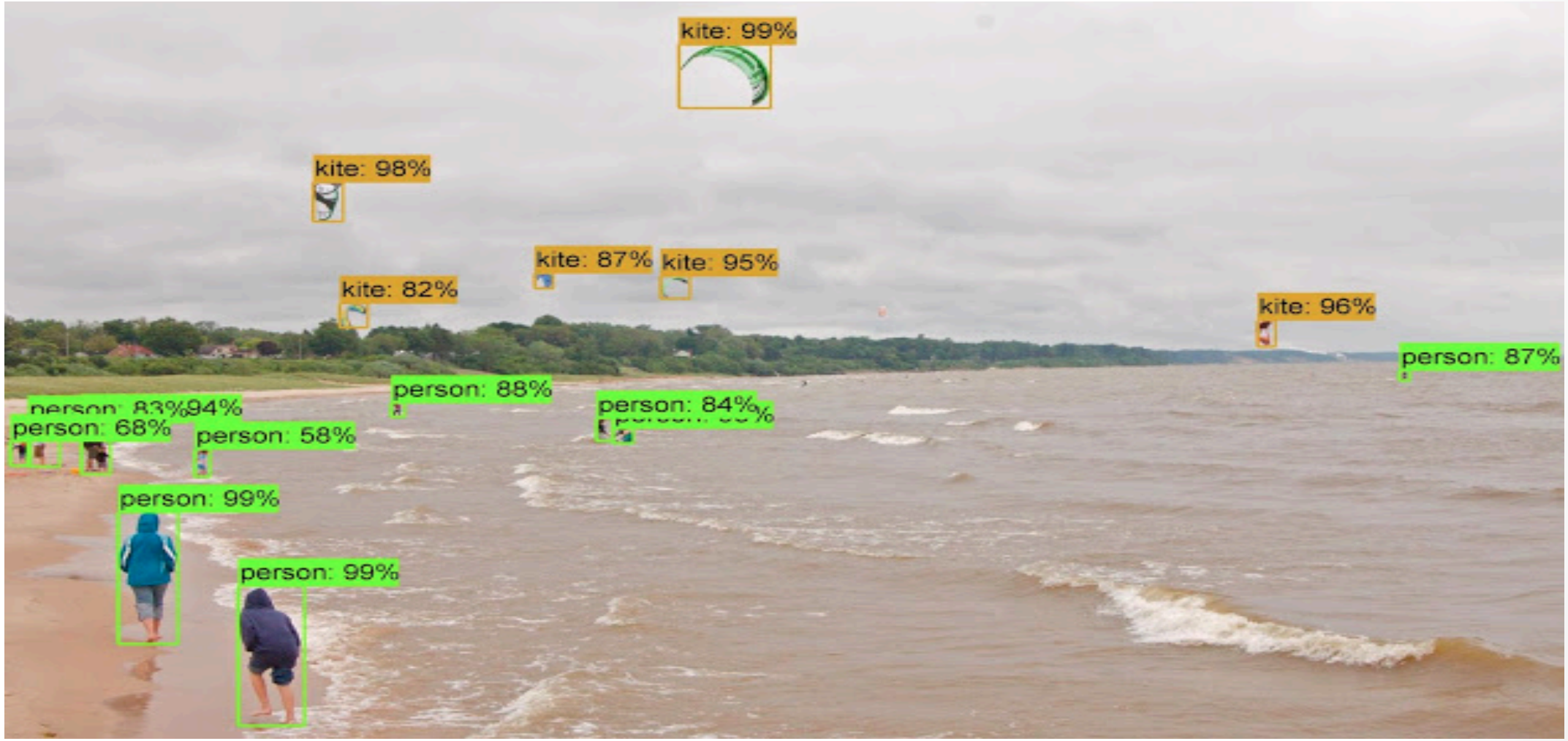
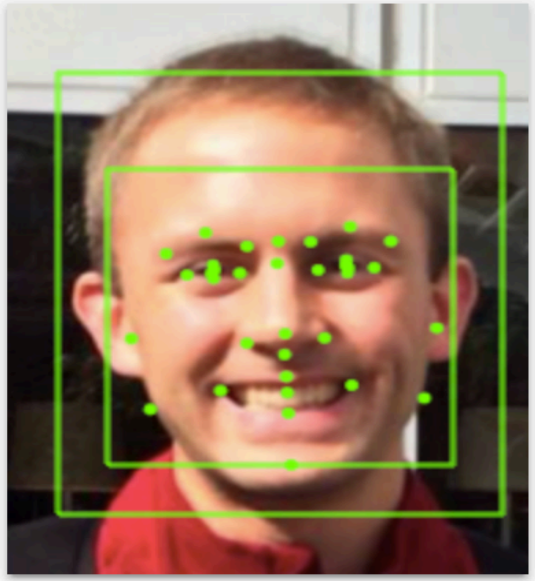
Deep Learning is Broadly Applicable



Object Detection with Deep Learning



Faces Can Be Classified by Neural Networks



David Gray screenshot.png

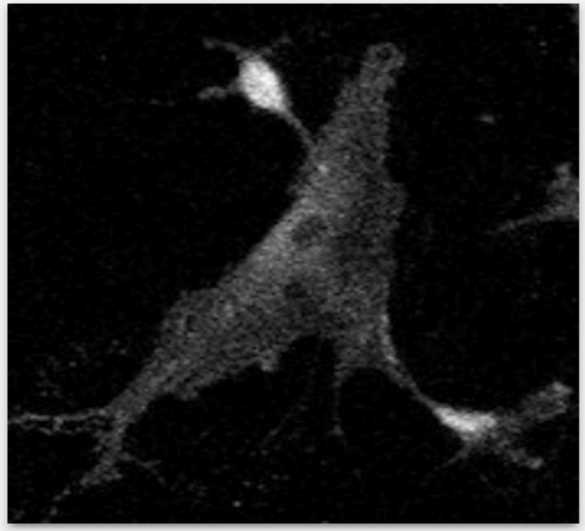
Joy	Very Likely
Sorrow	Very Unlikely
Anger	Very Unlikely
Surprise	Very Unlikely
Exposed	Very Unlikely
Blurred	Very Unlikely
Headwear	Very Unlikely

Roll: -3° Tilt: 2° Pan: 0°

Confidence 100%

Classify Mesenchymal Stem Cells (MSCs) as Done with Faces

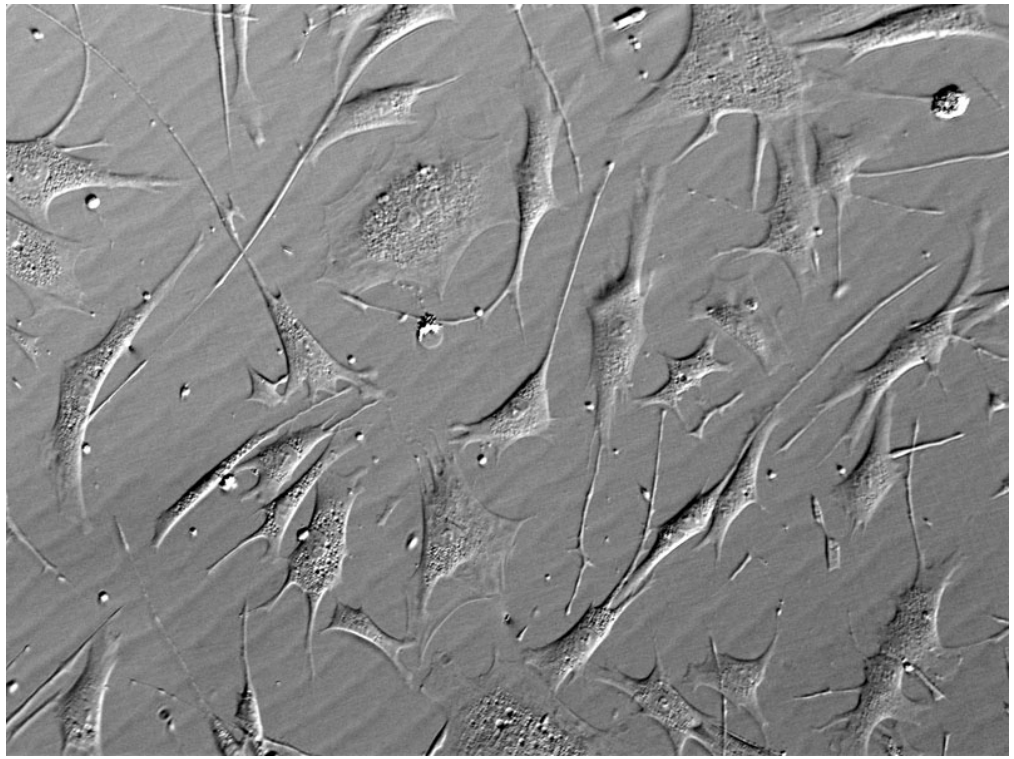
Black-and-white	78%
Darkness	78%
Font	69%
Monochrome	64%
Illustration	60%
Monochrome Photography	58%
Graphics	56%



Untitled.jpg

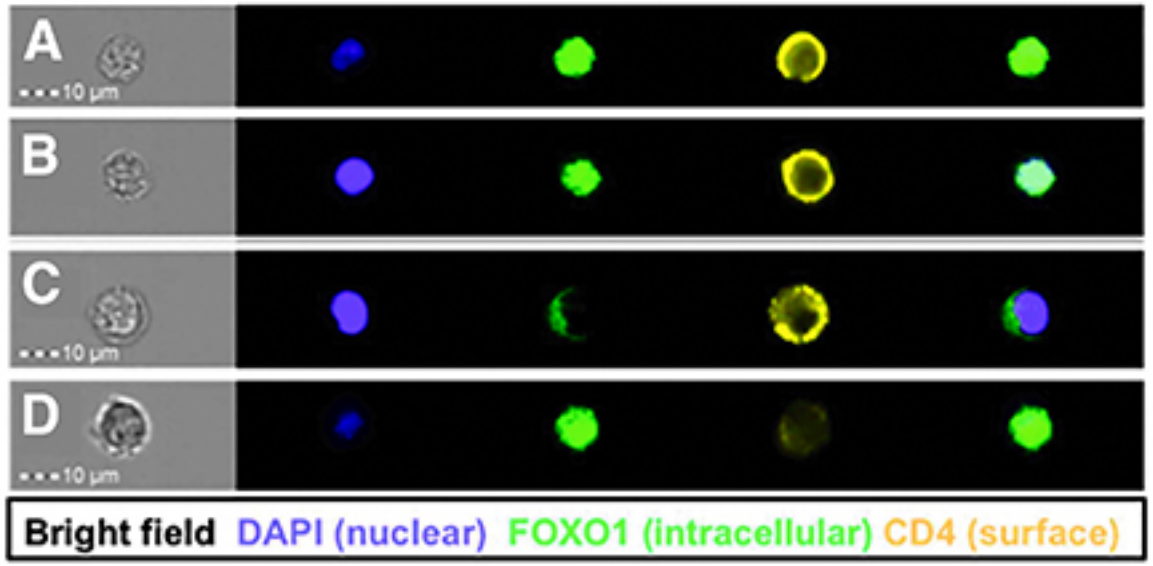
- Proliferation?
- Senescent?
- Identification?

Images were Collected from MSCs Grown in Monolayer and from Flow Cytometry



Monolayer

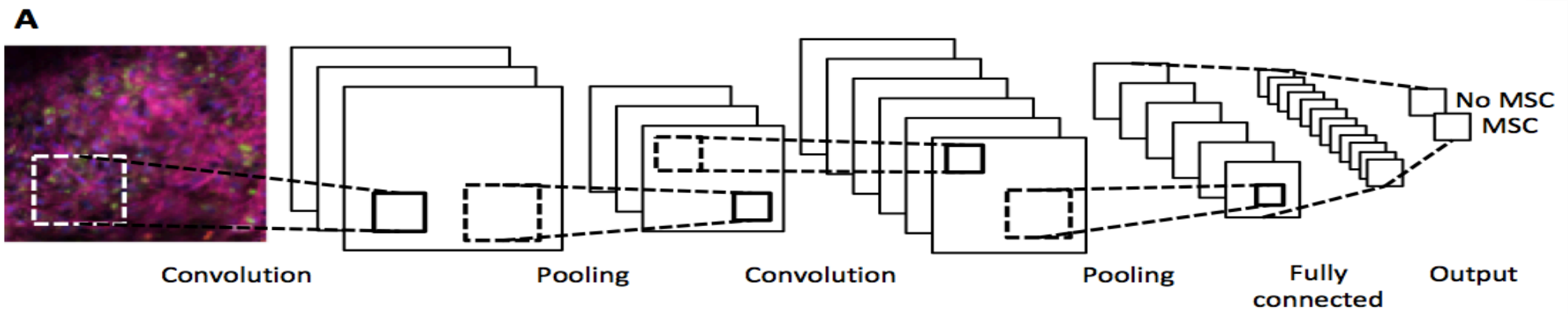
Cells were Segmented by Staining Nuclei

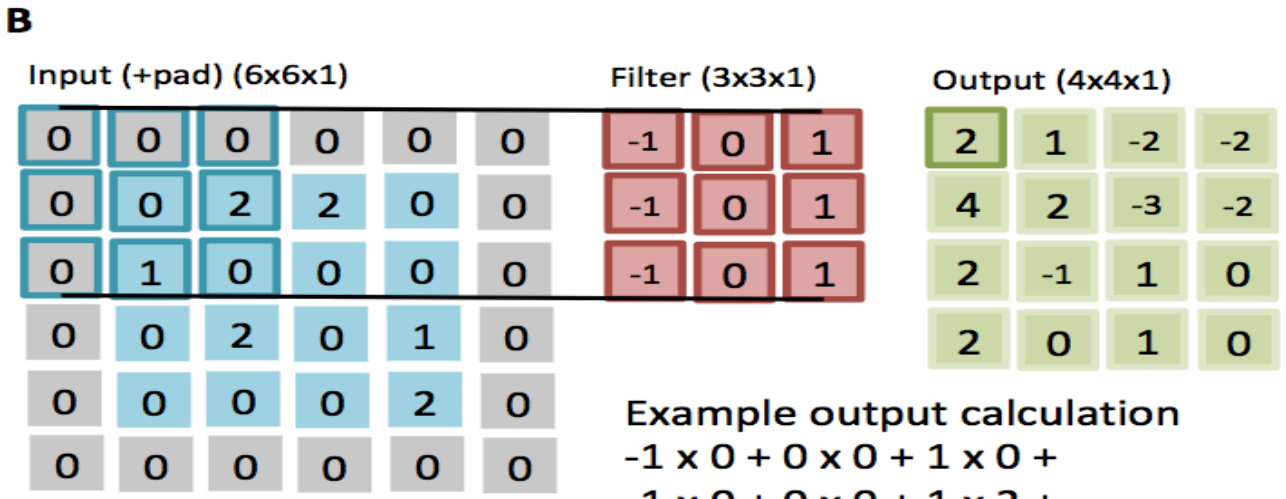


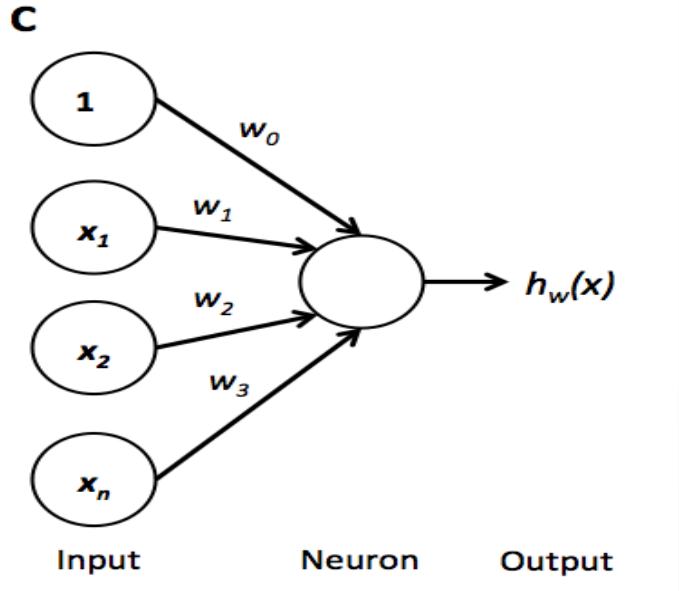
Flow Cytometry

Brightfield with Fluorescence Imaging of Cells in Flow

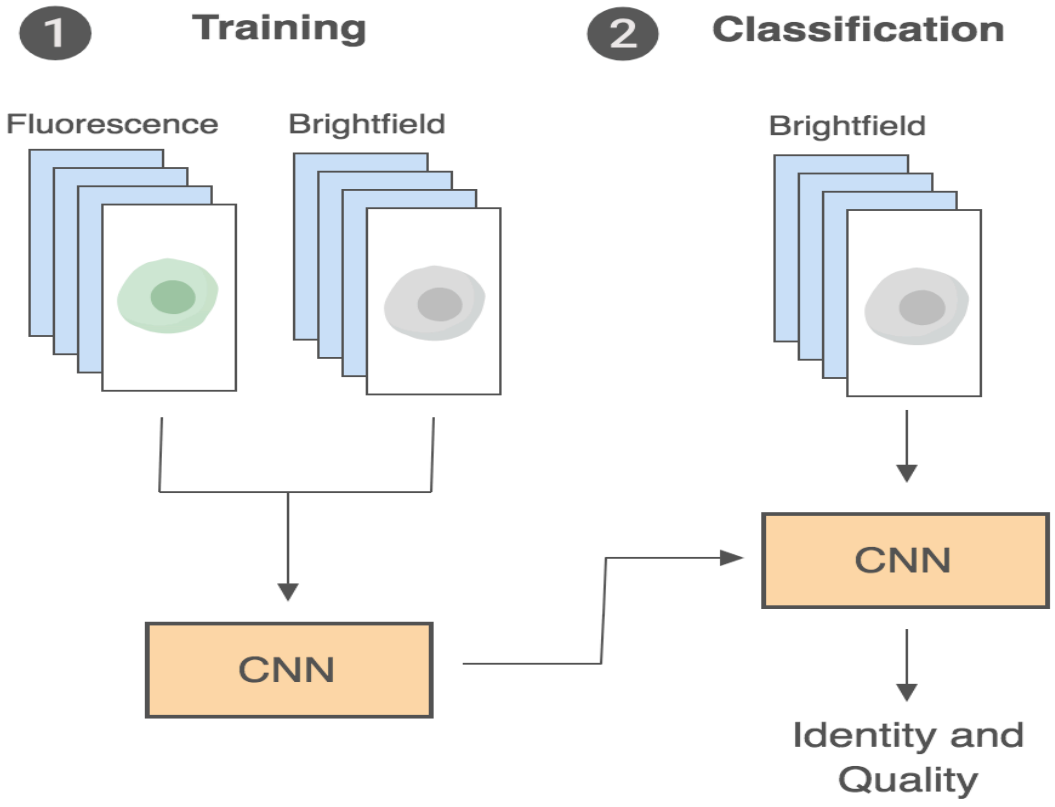
Technology – Finding Patterns







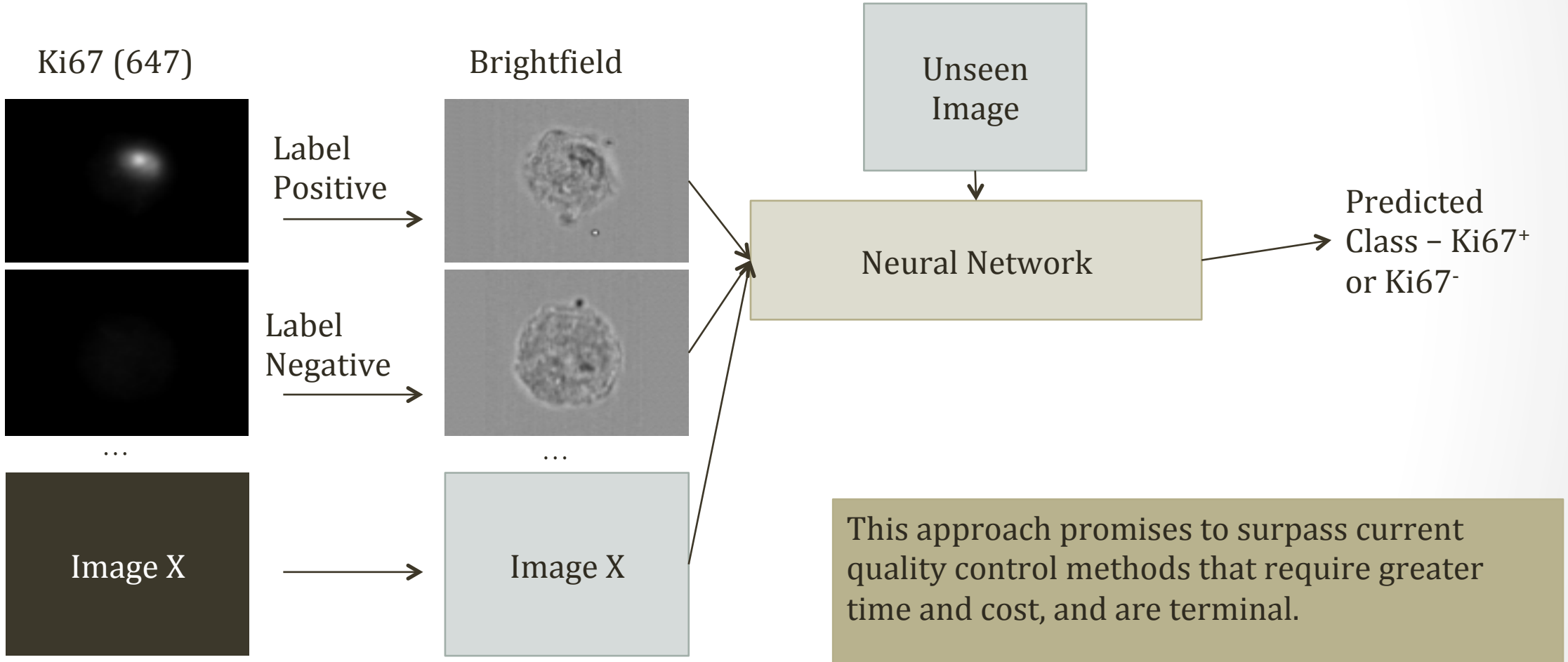
Neural Network Training and Classification



1. Brightfield images are labeled according to their fluorescence brightness and input into the CNN
2. Additional brightfield images that have not been processed are input into the CNN for classification.

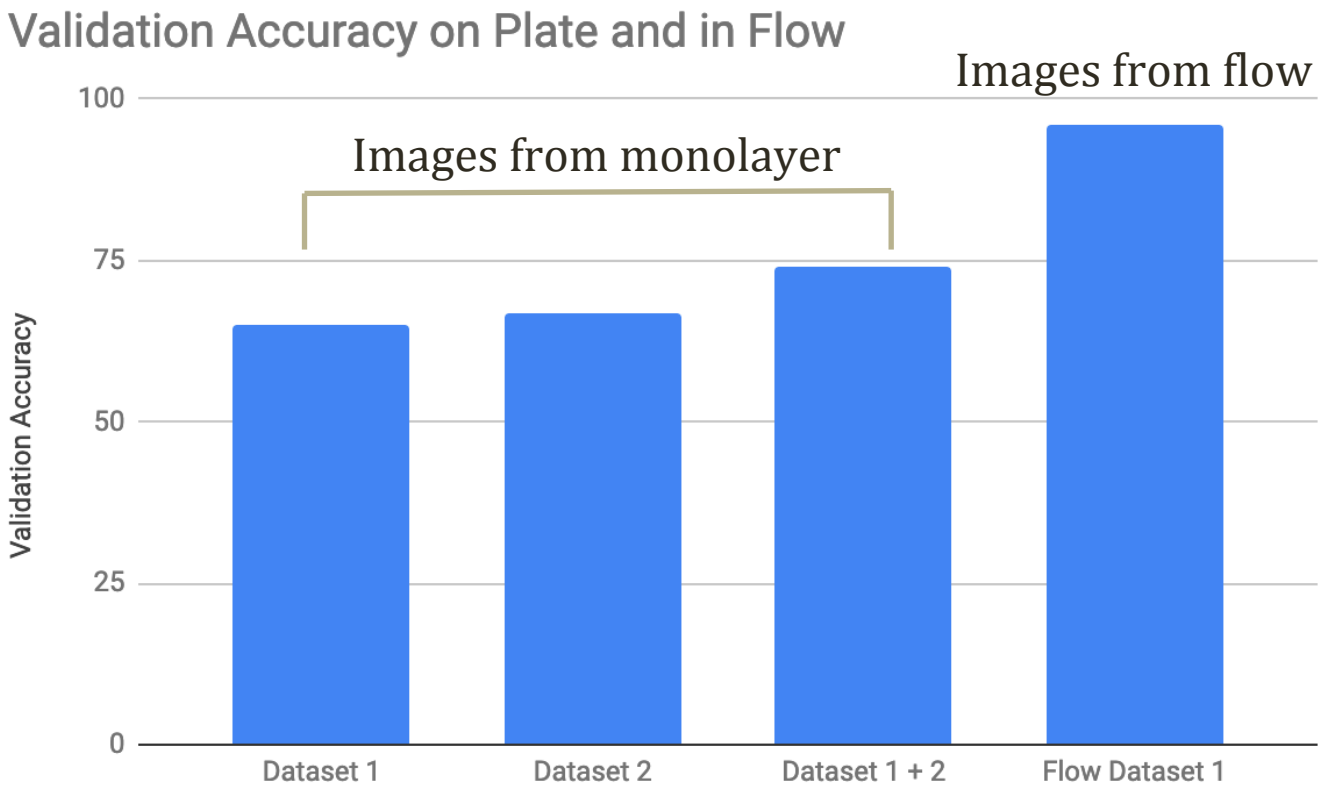
The uniqueness of this technology is the ability to determine cell phenotype rapidly and maintain viability

We Try to Predict Ki67 (Proliferation Marker) Expression from Brightfield Images Alone



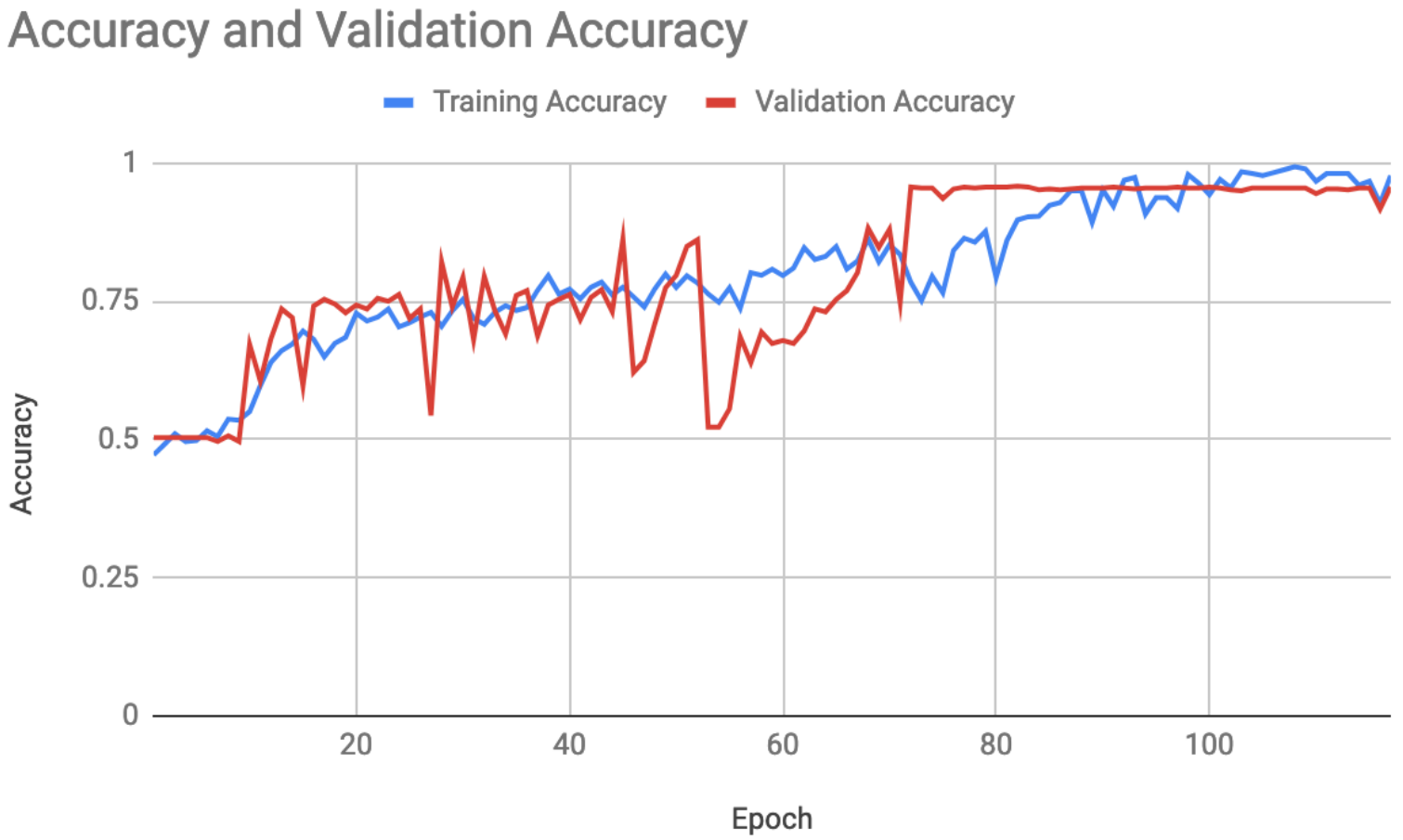
This approach promises to surpass current quality control methods that require greater time and cost, and are terminal.

Processing Images from Flow Cytometer Yielded Higher Accuracy than Monoloayer



Dataset 1, 2, and 1 + 2 were from a different donor than Flow Dataset 1

Training on Images from Flow Cytometry Gave 96% Accuracy



The Following are the Recommended Next Steps

- Verify Higher Accuracy of Flow Cytometry with Cells from More Donors
- Try to Improve Accuracy with More Training Images