

# Time Lapse IgG-induced Calcium Signaling Analysis for ALS Diagnosis

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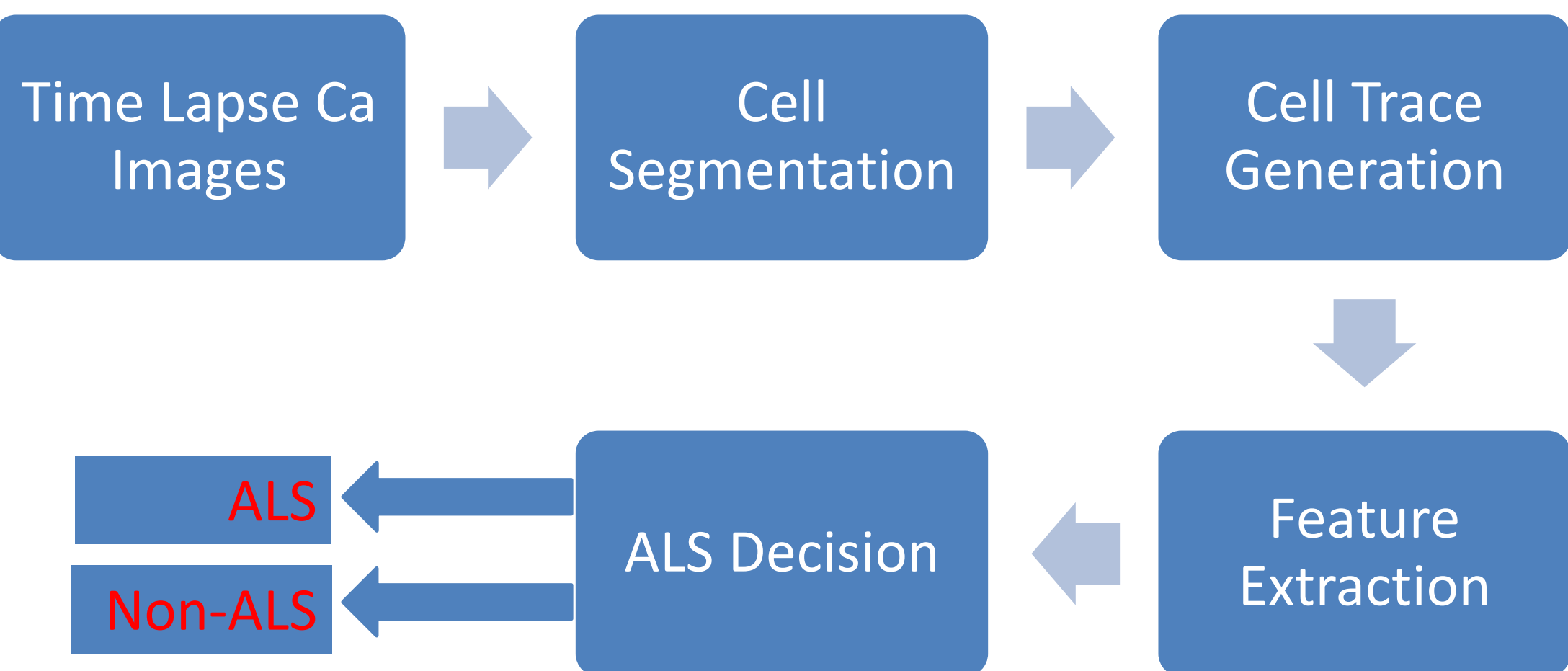
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## MOTIVATION

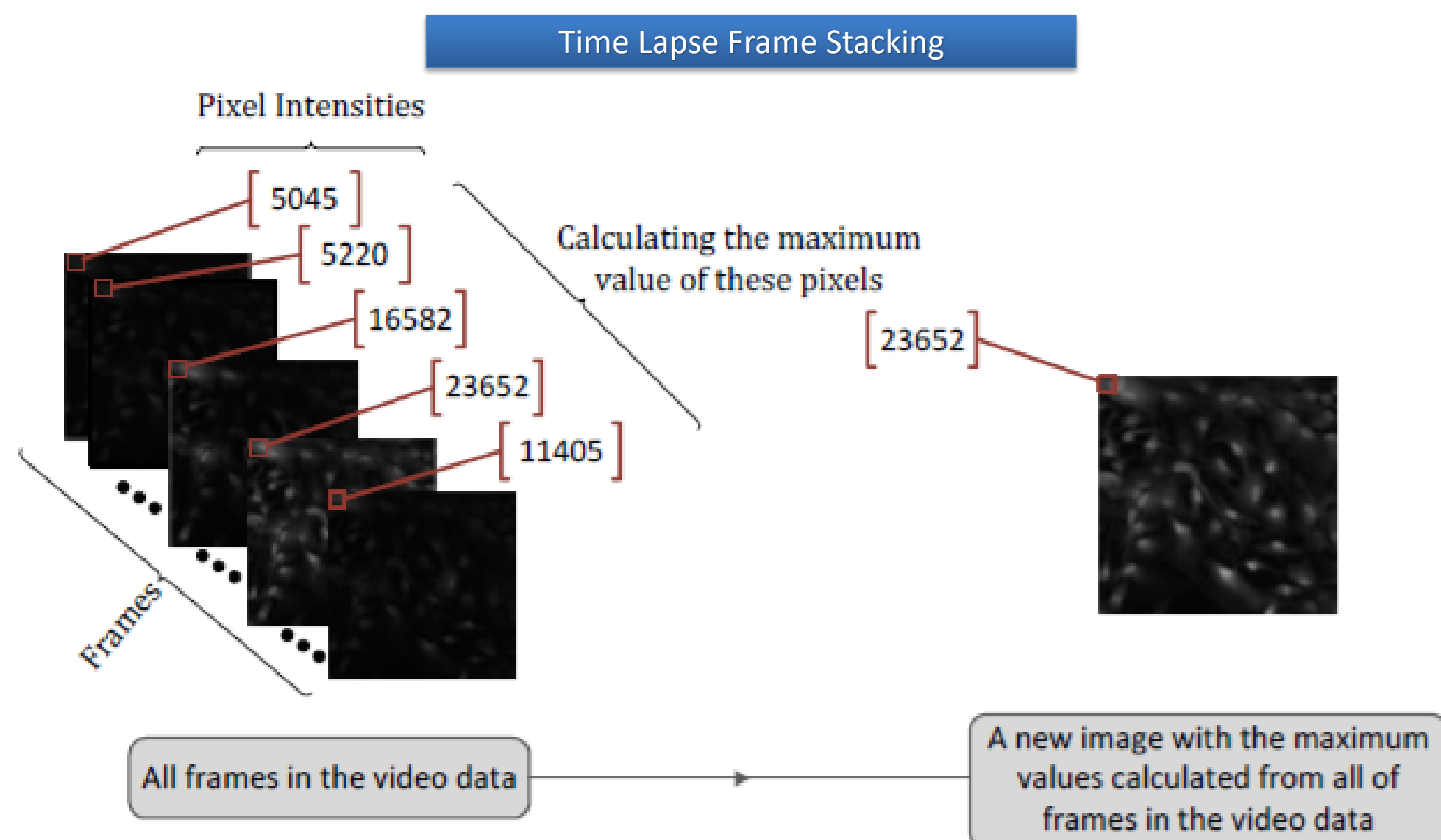


- We have shown that IgG from sera of ALS patients compared to control IgG induce calcium transients in cultured rat astrocytes.
- Our aim was to develop automated diagnostic screening for calcium signaling in order to classify ALS IgG.
- We have used time lapse calcium images, obtained in H2020-MSCA-RISE project "AUTOIGG".

## METHOD



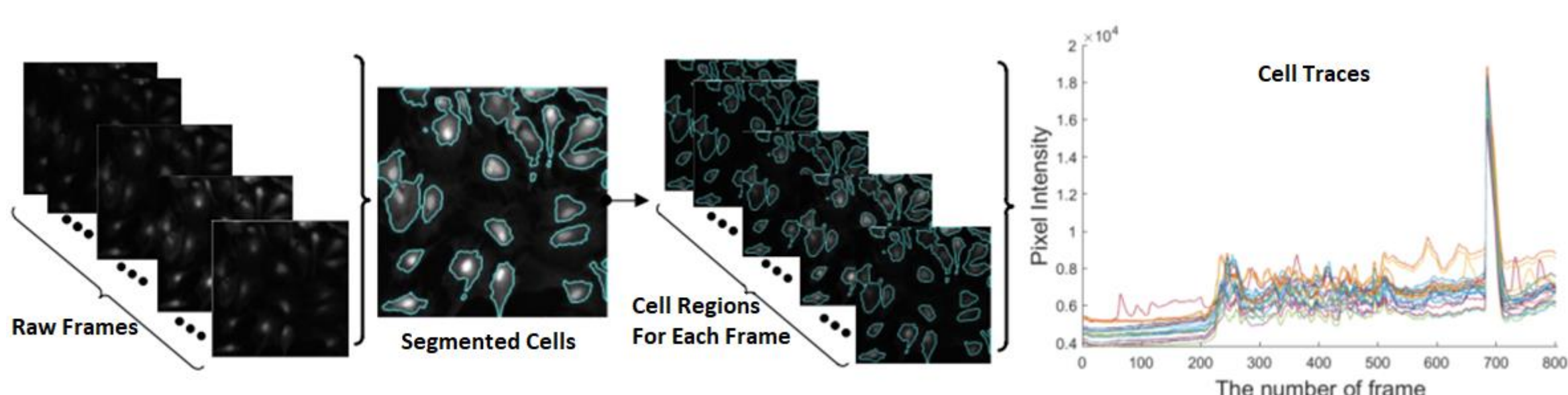
## Cell Segmentation



## Cell Boundary Detection

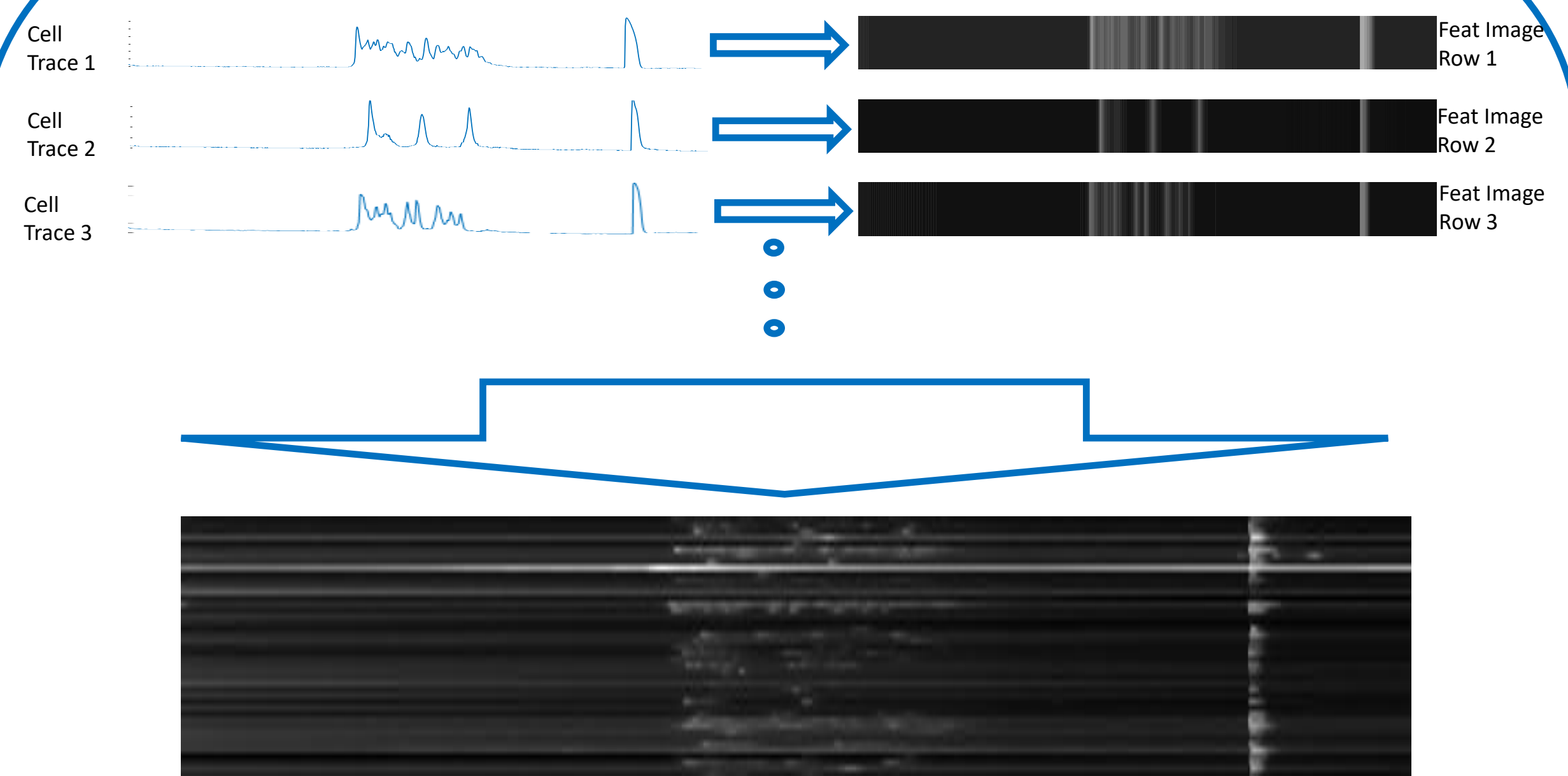


## Cell Trace Generation



- After cell segmentation step, each cell region is marked for each frame
- Average intensity values for cells are calculated for each frame
- Cell Traces are consist of average intensity values of cells along frame time axis.

## Feature Extraction



- 1-D Cell Trace Signals constructs the Feature Image
- Trace signal intensities represent the height of the calcium signal
- Each row of the Feature Image represents the Ca signal intensities for a cell
- Signal intensities are normalized to the range of [0 255] for 8-bit Feature Image
- Feature Image dimensions:
  - Number of rows: Number of cells
  - Number of columns: Number of frames

## ALS Decision

Dataset			
Name	Train	Test	Total
AUTOIGG Ca Dataset 1	7 ALS + 3 Control	3 ALS + 2 Control	10 ALS + 5 Control

## Machine Learning Methods

Support Vector Machine (SVM)	K-Nearest Neighbour (KNN)	Decision Trees
Fine Gaussian Kernel	K Number = 5	Boosted Tree

## RESULTS

Method Name	Validation Accuracy (5-Fold Validation)	Test Accuracy
Support Vector Machine (SVM)	97.2 %	96.5 %
K-Nearest Neighbour (KNN)	93.7 %	93.9 %
Decision Trees	98.3 %	98.2 %

- Rows of each Feature Images are shuffled (200 times) to be invariant across the cell order and to augment the dataset size
- MATLAB platform and its classifier learner toolbox is utilized for experiments
- Experimental results show that Decision Tree based classification methods outperforms other methods
- Result suggest that the proposed method is appropriate for automation of ALS diagnosis with the IgG calcium imaging setup.

## ACKNOWLEDGMENT

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