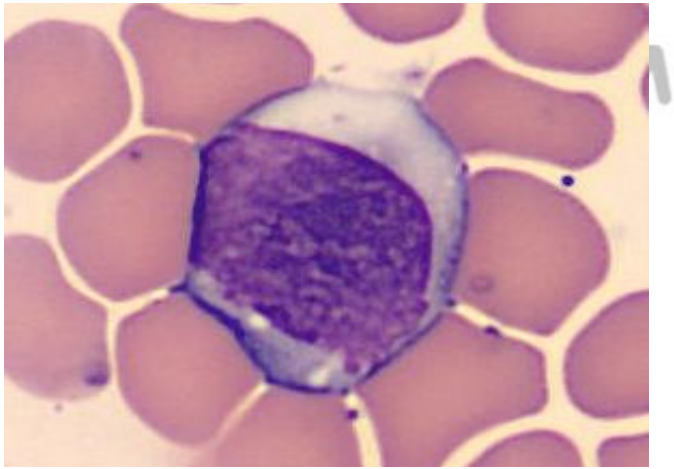
Approach 2 - Naive Deep Learning based Approach

What we will be covering in this module?

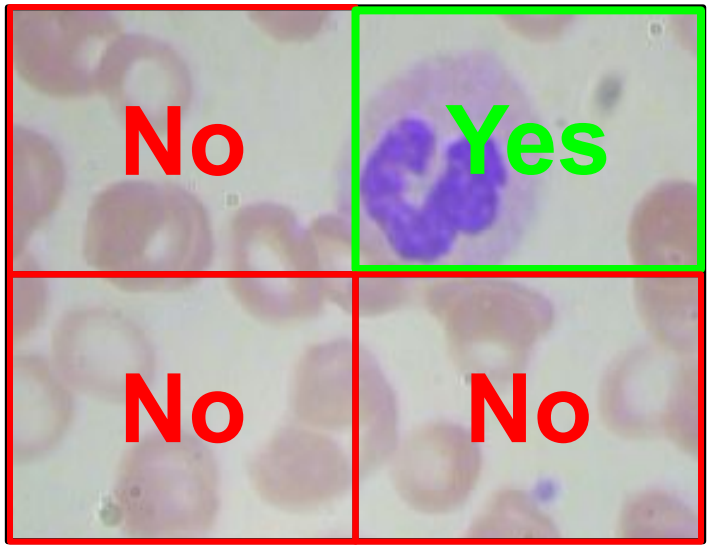
- Introduction is Image Segmentation
- How to solve Image Segmentation problems?
- Approaches for Image Segmentation
  - Use Traditional Methods
  - Leverage Deep Learning
- Understanding Deep Learning Architectures for Image Segmentation
- Project on Lane Segmentation for Self Driving Cars
- What's Next?

Approach to solve Blood Cell Segmentation



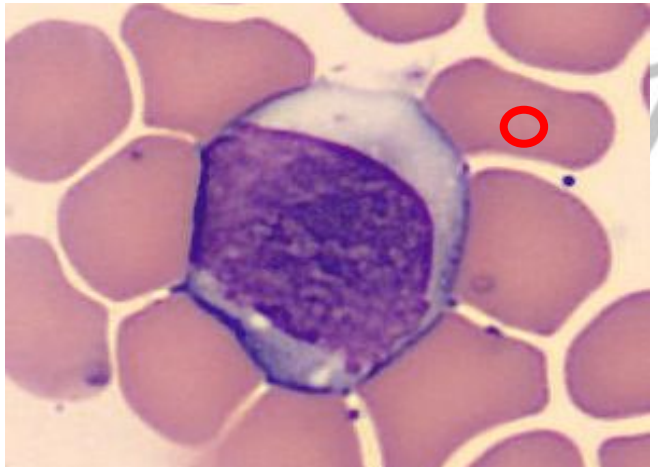
Deep Learning

Recap - Approach to solve Blood Cell Detection

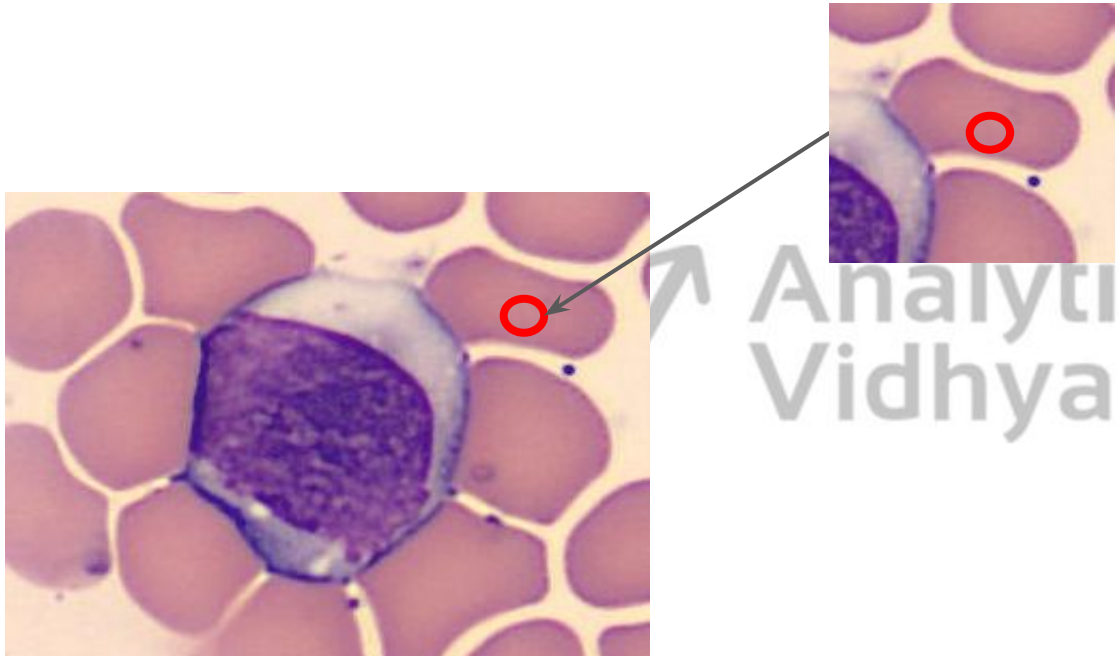


- **Step 1:** Divide image into patches
- **Step 2:** Classify each patch
- **Step 3:** Return Patch coordinates as bounding box

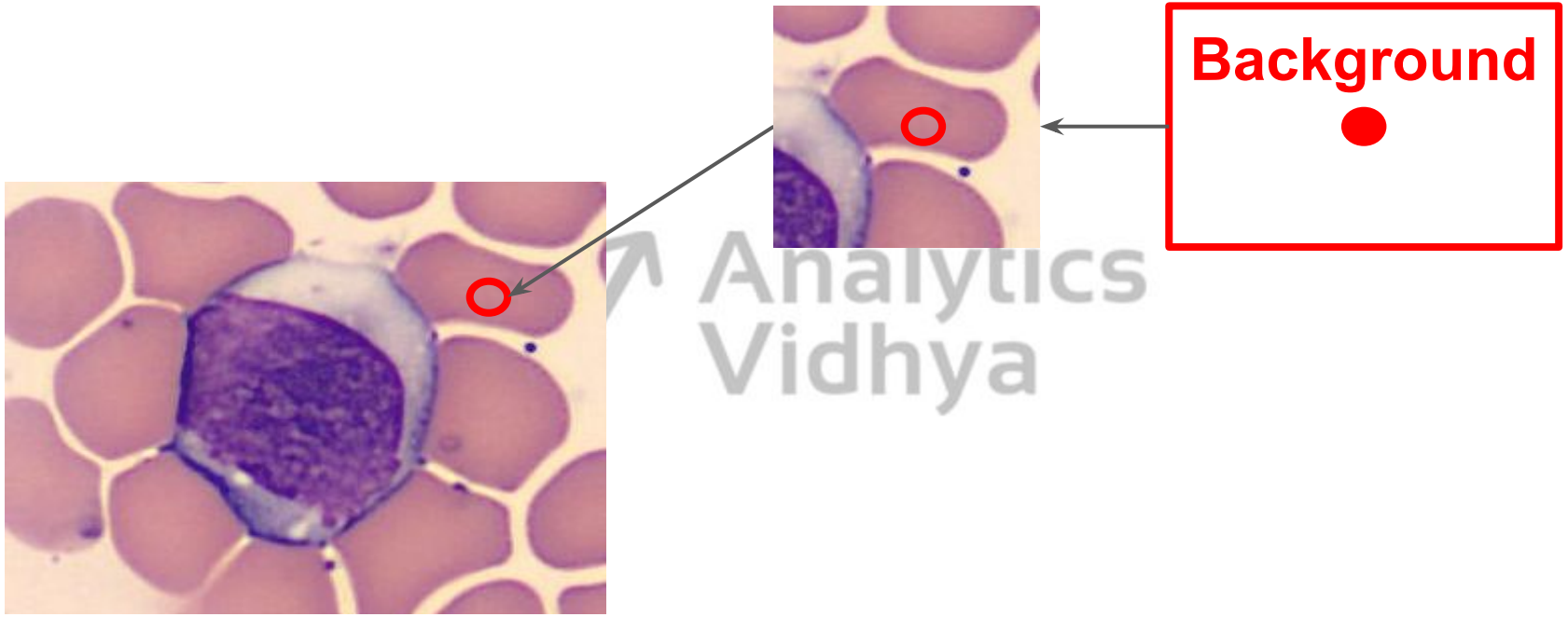
Naive Approach for Image Segmentation



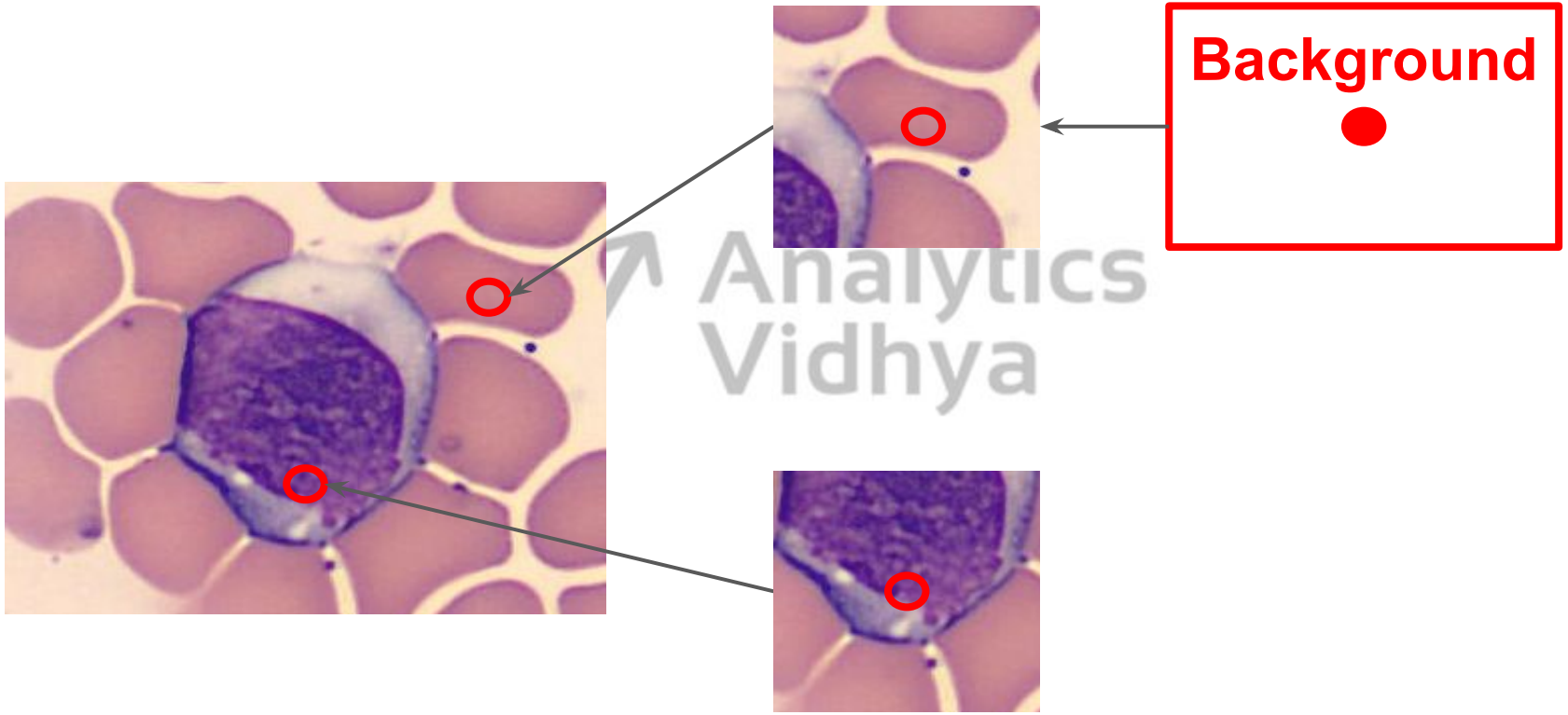
Naive Approach for Image Segmentation



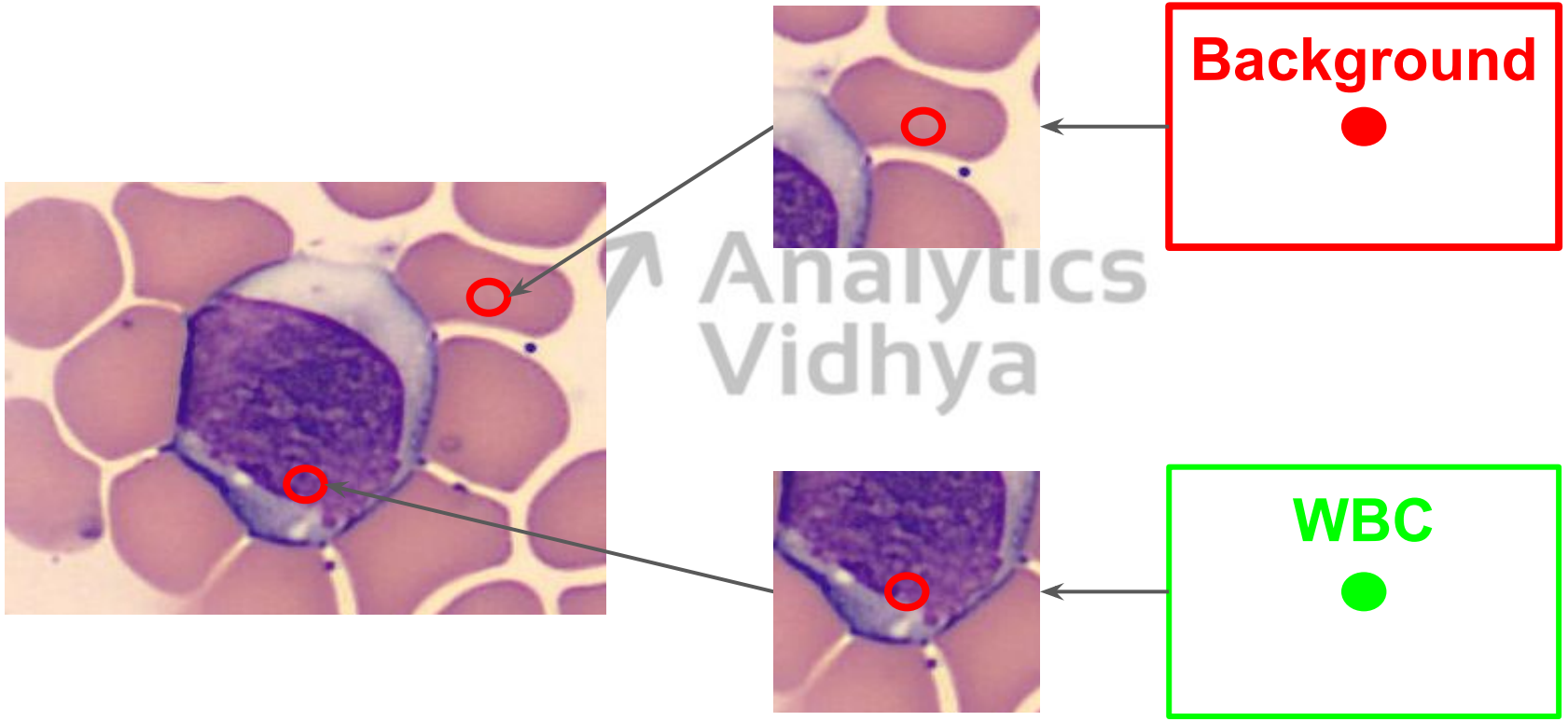
Naive Approach for Image Segmentation



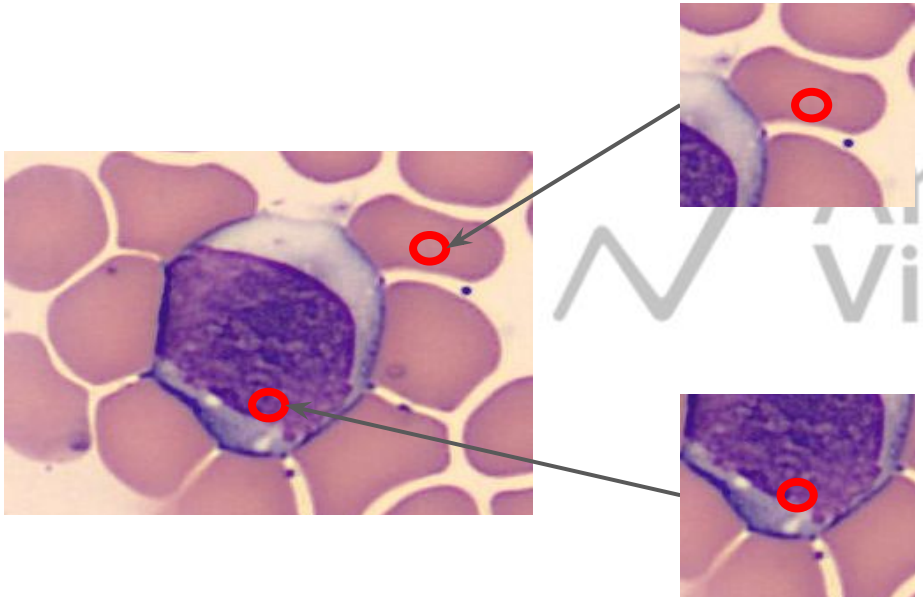
Naive Approach for Image Segmentation



Naive Approach for Image Segmentation



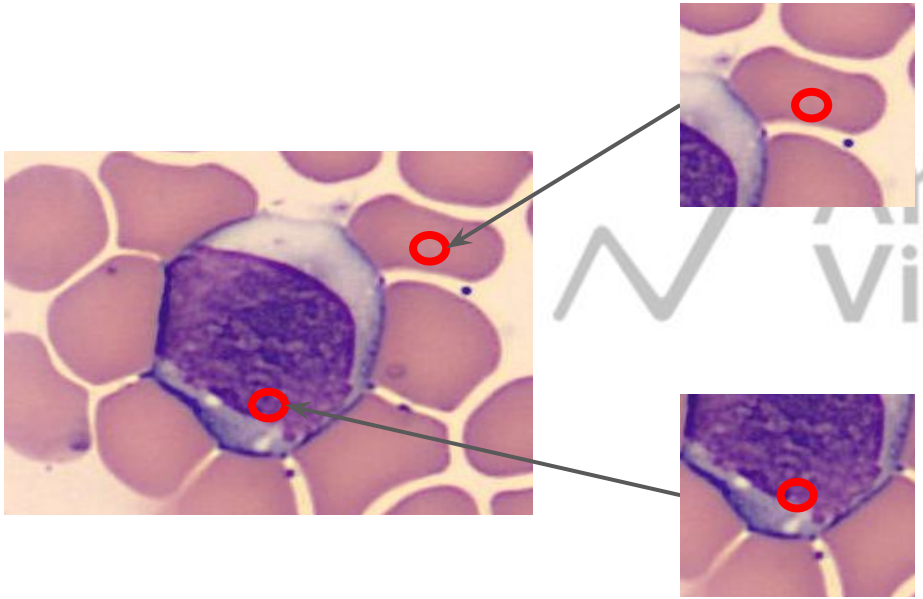
Naive Approach for Image Segmentation



- **Step 1:** Divide image into patches

  for every pixel

Naive Approach for Image Segmentation

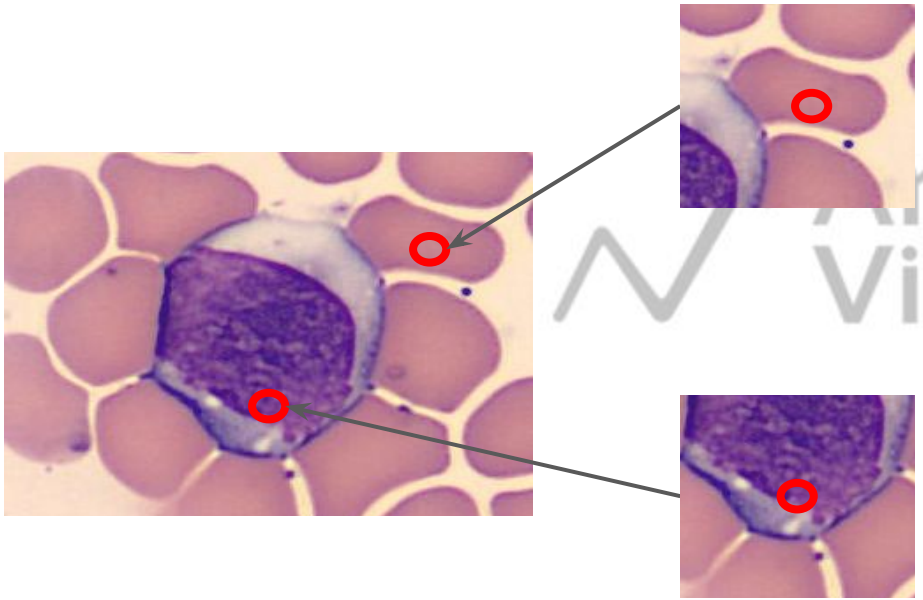


- **Step 1:** Divide image into patches

  for every pixel

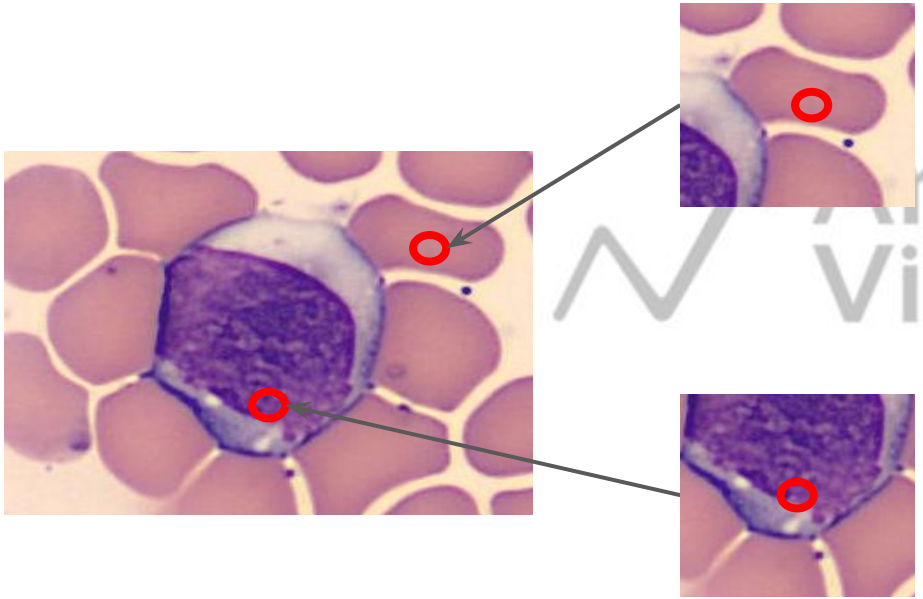
- **Step 2:** Classify each patch

Naive Approach for Image Segmentation



- **Step 1:** Divide image into patches for every pixel
- **Step 2:** Classify each patch
- **Step 3:** Return output as a heatmap of predictions

Naive Approach for Image Segmentation



- **Step 1:** Divide image into patches for every pixel
- **Step 2:** Classify each patch
- **Step 3:** Return output as a heatmap of predictions
- **Step 4**: Threshold heatmap

Naive Approach for Image Segmentation

Pros:

- Not just based on color, extracts features in an intelligent way

Naive Approach for Image Segmentation

Pros:

- Not just based on color, extracts features in an intelligent way
- May performs better than heuristics based approaches

Naive Approach for Image Segmentation

Pros:

- Not just based on color, extracts features in an intelligent way
- May performs better than heuristics based approaches

Cons:

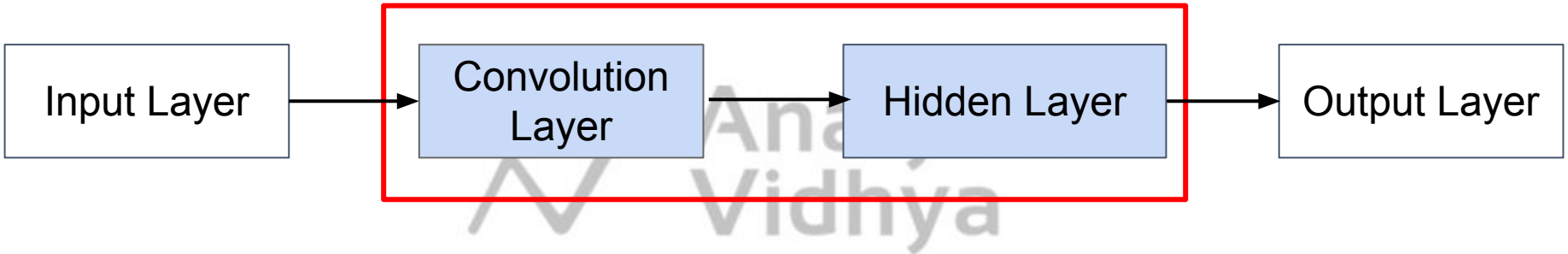
- Too computationally expensive to even be feasible

Improvements in Naive Approach

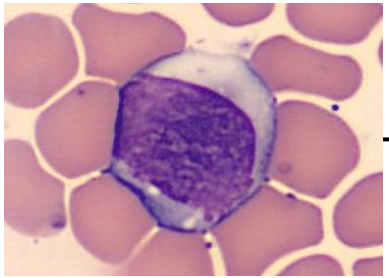
Improvement:

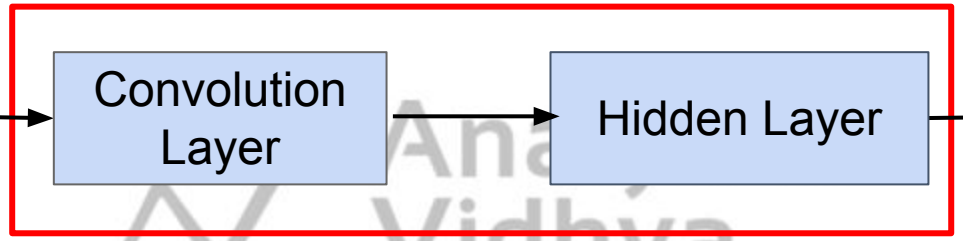
- A single CNN which works on input image and gives an output heatmap

Recap - CNN for Image Classification



CNN for Image Segmentation

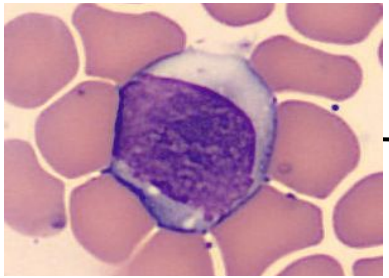


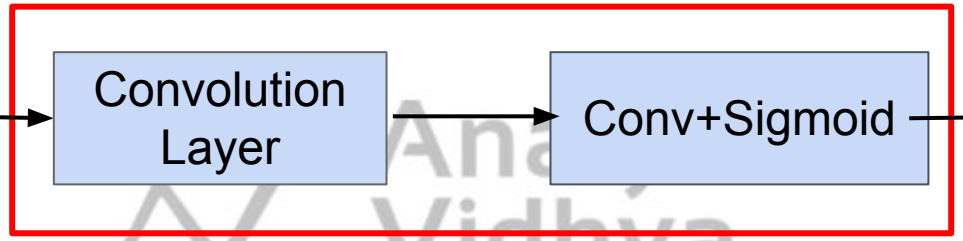


?

Feature Extractor

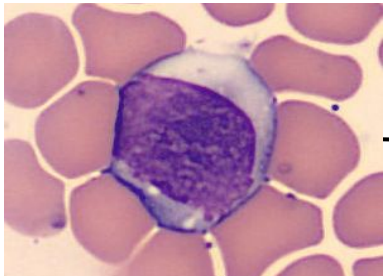
Modified CNN for Image Segmentation

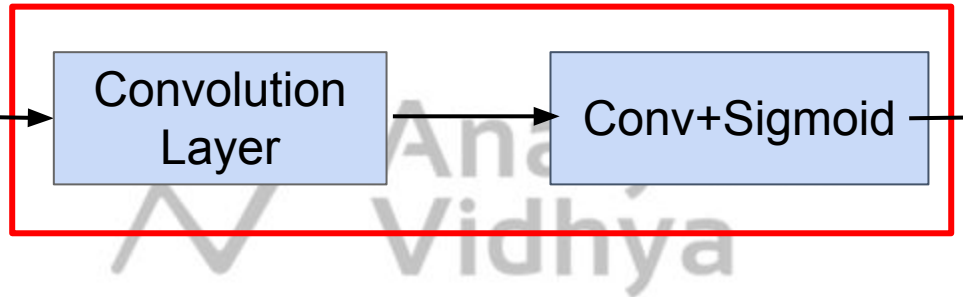




Feature Extractor

Modified CNN for Image Segmentation





Feature Extractor

Binary Cross-Entropy Loss

Improvements in Naive Approach

Improvement:

- A single CNN which works on input image and gives an output heatmap

Pros:

- Computationally less expensive

Improvements in Naive Approach

Improvement:

- A single CNN which works on input image and gives an output heatmap

Pros:

- Computationally less expensive

Cons:

- Output not of the same size

Improvements in Naive Approach

Improvements:

- A single CNN which works on input image and gives an output heatmap
- No pooling layer

Pros:

- Computationally less expensive

Improvements in Naive Approach

Improvements:

- A single CNN which works on input image and gives an output heatmap
- No pooling layer

Pros:

- Computationally less expensive

Cons:

- Output not of same size (due to undefined padding,stride in conv layer)

Improvements in Naive Approach

Improvements:

- A single CNN which works on input image and gives an output heatmap
- No pooling layer, conv layer with stride as 1

Improvements in Naive Approach

Improvements:

- A single CNN which works on input image and gives an output heatmap
- No pooling layer, conv layer with stride as 1 (pad accordingly)

Improvements in Naive Approach

Improvements:

- A single CNN which works on input image and gives an output heatmap
- No pooling layer, conv layer with stride as 1 (pad accordingly)

Pros:

- Computationally less expensive

Improvements in Naive Approach

Improvements:

- A single CNN which works on input image and gives an output heatmap
- No pooling layer, conv layer with stride as 1 (pad accordingly)

Pros:

- Computationally less expensive
- Output of same size

Improvements in Naive Approach

Improvements:

- A single CNN which works on input image and gives an output heatmap
- No pooling layer, conv layer with stride as 1 (pad accordingly)

Pros:

- Computationally less expensive
- Output of same size

Cons:

- Options for DL architecture is limited

Steps for Image Segmentation using CNN based model

1. Data Loading and Preprocessing

Analytics Vidhya

Steps for Image Segmentation using CNN based model

1. Data Loading and Preprocessing

1.1 Load the Data

Analytics Vidhya

Steps for Image Segmentation using CNN based model

1. Data Loading and Preprocessing

1.1 Load the Data

1.2 Define custom dataset and dataloader

Steps for Image Segmentation using CNN based model

1. Data Loading and Preprocessing

1.1 Load the Data

1.2 Define custom dataset and dataloader

1.3 Data Exploration

Steps for Image Segmentation using CNN based model

1. Data Loading and Preprocessing

1.1 Load the Data

1.2 Define custom dataset and dataloader

1.3 Data Exploration

2. Image Segmentation through CNN based model

Steps for Image Segmentation using CNN based model

1. Data Loading and Preprocessing

1.1 Load the Data

1.2 Define custom dataset and dataloader

1.3 Data Exploration

2. Image Segmentation through CNN based model

2.1 Define model architecture

Steps for Image Segmentation using CNN based model

1. Data Loading and Preprocessing

1.1 Load the Data

1.2 Define custom dataset and dataloader

1.3 Data Exploration

2. Image Segmentation through CNN based model

2.1 Define model architecture

2.2 Train the model

Steps for Image Segmentation using CNN based model

1. Data Loading and Preprocessing

1.1 Load the Data

1.2 Define custom dataset and dataloader

1.3 Data Exploration

2. Image Segmentation through CNN based model

2.1 Define model architecture

2.2 Train the model

2.3 Calculate IoU score

Thank you

Code Walkthrough of Improved Naive Approach

Summary of Naive DL based Approach

Pros:

- Single CNN network (almost end to end)

Summary of Naive DL based Approach

Pros:

- Single CNN network (almost end to end)
- Performs better than heuristics based approaches

Summary of Naive DL based Approach

Pros:

- Single CNN network (almost end to end)
- Performs better than heuristics based approaches
- Generalizes well for unseen data

Summary of Naive DL based Approach

Pros:

- Single CNN network (almost end to end)
- Performs better than heuristics based approaches
- Generalizes well for unseen data

Cons:

- Feasible but still computationally expensive (as no pooling layer is used)

Summary of Naive DL based Approach

Pros:

- Single CNN network (almost end to end)
- Performs better than heuristics based approaches
- Generalizes well for unseen data

Cons:

- Feasible but still computationally expensive (as no pooling layer is used)
- Options for DL architecture is limited

Summary of Naive DL based Approach

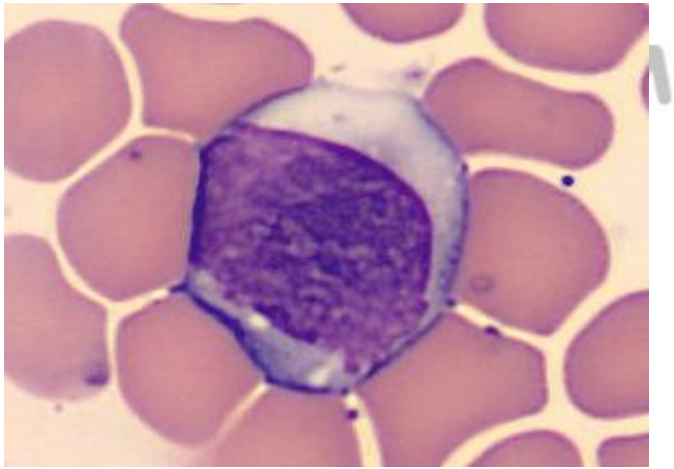
Pros:

- Single CNN network (almost end to end)
- Performs better than heuristics based approaches
- Generalizes well for unseen data

Cons:

- Feasible but still computationally expensive (as no pooling layer is used)
- Options for DL architecture is limited
- Simplistic DL model, doesn't take ideas from complex networks

Approach to solve Blood Cell Segmentation



Advanced
Deep Learning

Thank you