Project B: Cell classification using convolutional neural networks

Group 2

Team Members and Work Distribution

Team:

Abimathi Siva Subramanian   403592   (Member 1)
Anna Garoufali   405801   (Member 2)
Daria Gelbich   405860   (Member 3)
Rohan Krishna Balaji   403596   (Member 4)

Tasks:

1) Image Pre-processing –   1,2,3,4

2) Data Augmentation –   1,2,3,4

3) Training of CNN -   1,2,3,4

4) Presentation slides preparation – 1,2,3,4

IAM Institut für Allgemeine Mechanik | RWTH AACHEN UNIVERSITY

Project Description

Aim: Classification of given images into Chondrocytes and Stem cells.

Machine learning algorithm used : Convolutional Neural Network

Initial Configuration

Image Pre-processing: Gray scale

Data Augmentation   : Flipped Images

Architecture   : LeNet-5

Final configuration

Image Pre-processing : Gray scale

Data Augmentation   : Flipped Images

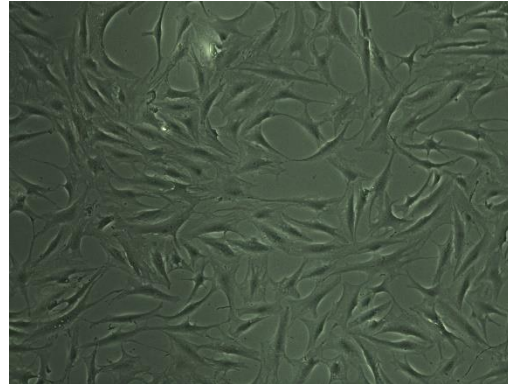Architecture   : Architecture from

research paper**

Result: Accuracy with / without Data Augmentation

- ******G. C. Lee, K. Haung, C. Sun and Y. Liao, "Stem cell detection based on Convolutional Neural Network via third harmonic generation microscopy images,"
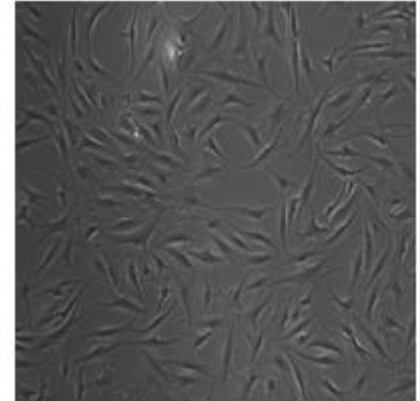
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Image Preprocessing

1) Conversion of the image from image format to an array

2) Resizing of image to reduce number of pixels from 2560 x 1920 to 32 x 32 pixels

3) Conversion to Grayscale

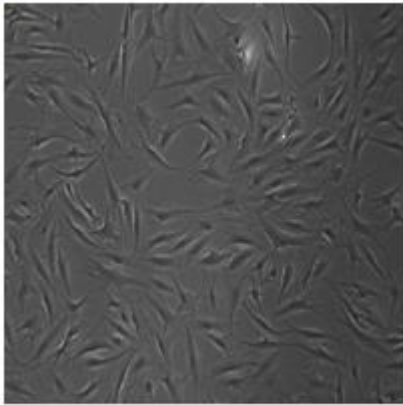4) Normalization of the grayscale value

Original Image

Preprocessed Image

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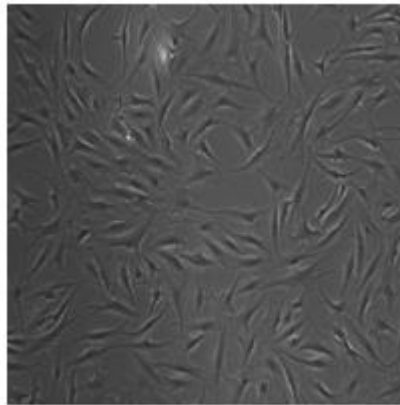04.02.2021

Data Augmentation

Purpose: Increase the amount of training data and the diversity of the image.
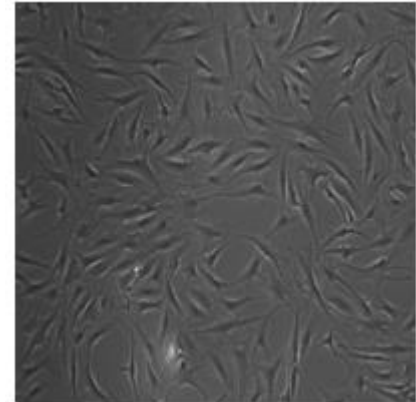
Method used : Flipped Images

Horizontal Flipped Image

Original Image

Vertical Flipped Image

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Implementation of a convolutional neural network for classification

Layer 1: Convolution layer
Kernel size = (7,7) , Stride = (1,1)

Layer 2: Max Pooling Layer
Pool size = (2,2) , Stride = 2

Layer 3: Convolution layer
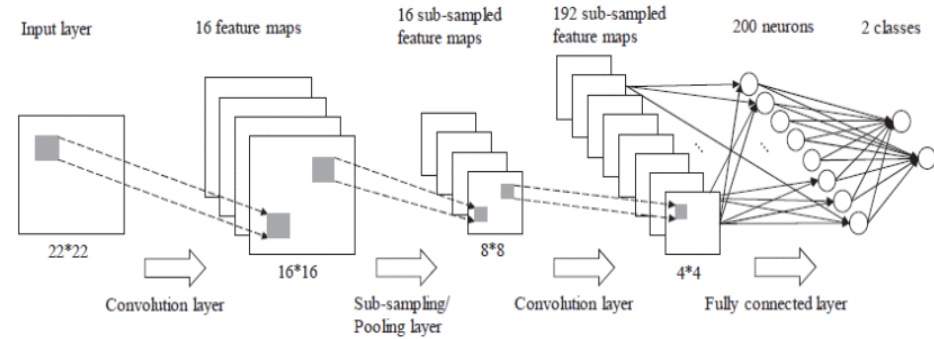Kernel size = (5,5) , Stride = (1,1)

Layer 4: Flattened Layer

Layer 5: Dense Fully Connected hidden layer
Number of neurons = 200, activation= ReLU

Layer 6: Output layer
Number of neurons = 1, activation = Sigmoid

G. C. Lee, K. Haung, C. Sun and Y. Liao, "Stem cell detection based on Convolutional Neural Network via third harmonic generation microscopy images,"

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Results

Metrics	LeNet-5 Without Data Augmentation	LeNet-5 With Data Augmentation	Optimized model without Data Augmentation	Optimized model with Data Augmentation
Training loss	0.0043	2.6820e-06	0.0124	0.1651
Validation Loss	0.3029	0.5089	0.7353	0.1537
Training accuracy	1.0	1.0	1.0	0.9407
Validation accuracy	0.907	0.929	0.907	0.9685

Results

LeNet-5 Without Data Augmentation	LeNet-5 with Data Augmentation	Optimized model without Data Augmentation	Optimized model with Data Augmentation
1	1	1	1
1	1	1	1
0	1	0	1
1	1	1	1
0	0	0	0
0	0	0	0
0	1	0	1
1	1	1	1
1	0	1	0
1	1	1	1

Chondrocytes = 1
Stem cells = 0

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Discussion/Conclusion

- Data Augmentation has significant influence in the accuracy of the model.

- The number of fully connected layer does not influence greatly the performance of the model .

- We can classify the image into Chondrocytes and Stem cells with an accuracy of **96.85**% using the optimized model.

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Thank You

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