MACHINE LEARNING FOR ANDROID APPLICATIONS

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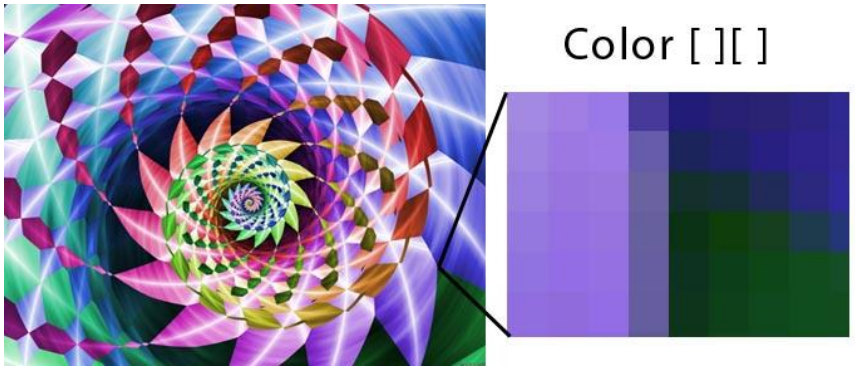
Introduction

- How cool it would be to have image recognition on your Android phone?
- A lot of software available in C, C++, and Java for Android
- Neuroph provides a simple API to work with neural networks
- Since version 2.6, Neuroph provides a compatibility layer to run image recognition on Android
  - Libraries loaded as .jar files
  - Code in JAVA
- Note that this is a very basic example, a kind of 'Hello World' for image recognition
  - But if you get deeper into this you might be able to get more advanced stuff.

Image Processing Fundamentals

- An image is a 2D array of colors
- Each array position is a tuple of three basic colors: red, green and blue (RGB).
- Each color can be represented as a combination of these three colors.
- When all colors have the same value the result is a grayscale value
- By thresholsing the grayscale value we get a black and white image



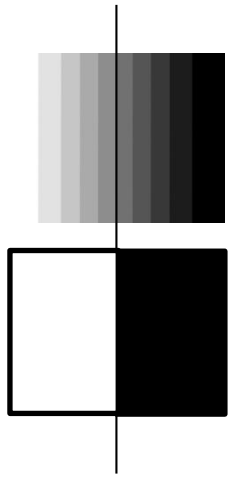
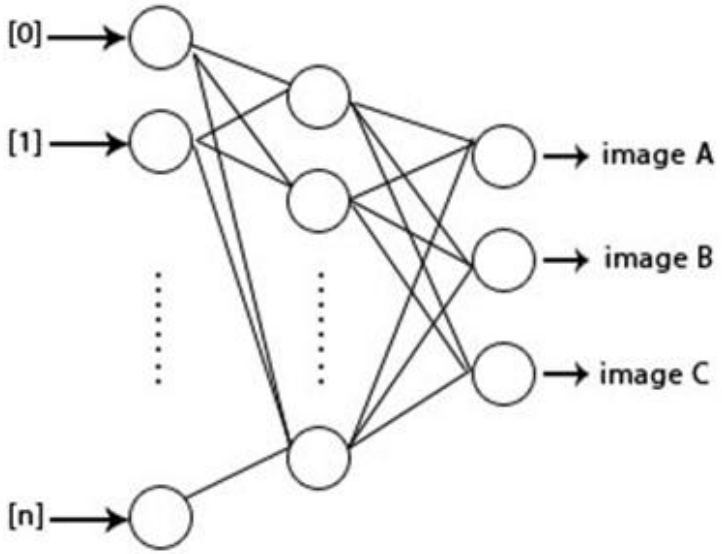


Image Recognition with Neural Networks

- Create a single one-dimensional array so it contains all red values, then all green and at the end all blue values.
- Feeding the image vector to a multi layer perceptron.
- Each input neuron corresponds to a vector element.
- Each output neuron corresponds to one image or image class. So if network output is [1, 0, 0] that means that input is recognized as 'image A'.



Challenges of Recognition Using Video

- Variations in object size, shape, orientation
- Changes in Brightness
- Shadows
- Noise
- Object location within the image
- Many More…

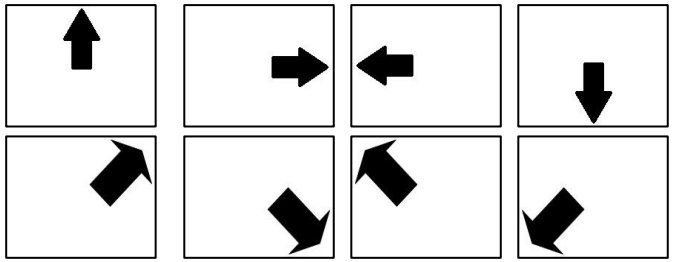
- Complex Feature Extraction
- Image Preprocessing

Neural Network for Image Recognition

- Neuroph Studio
  - Create Neuroph project
  - Create image recognition neural network
  - Train network
  - Test network
  - Save & deploy network for Arrow Recognition

- Numbers:

- Arrows:



The Android Application

- Initial Step:
  - Download and run a simple camera application
- Step 1:
  - Add some simple image processing
  - Run the app again with the new output
- Step 2:
  - Integrate machine learning to Android application
  - Do recognition using device camera

Application Interface

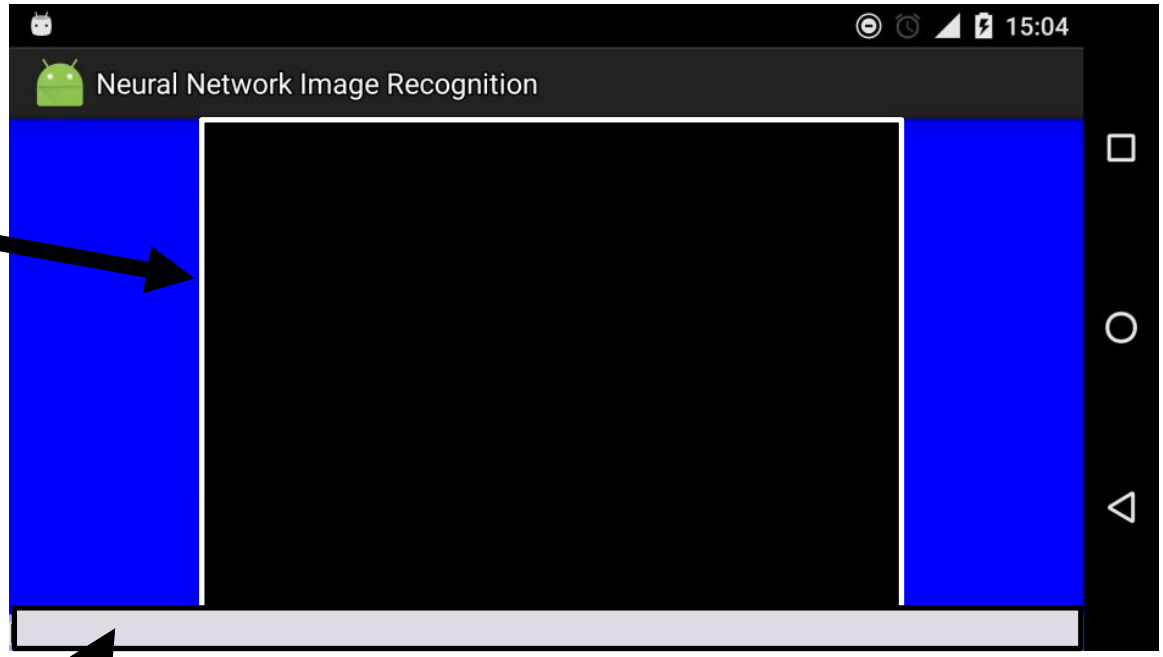
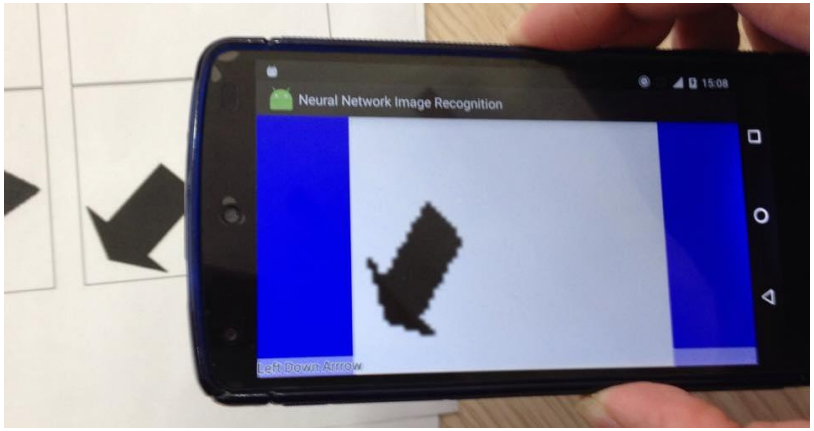


Image View

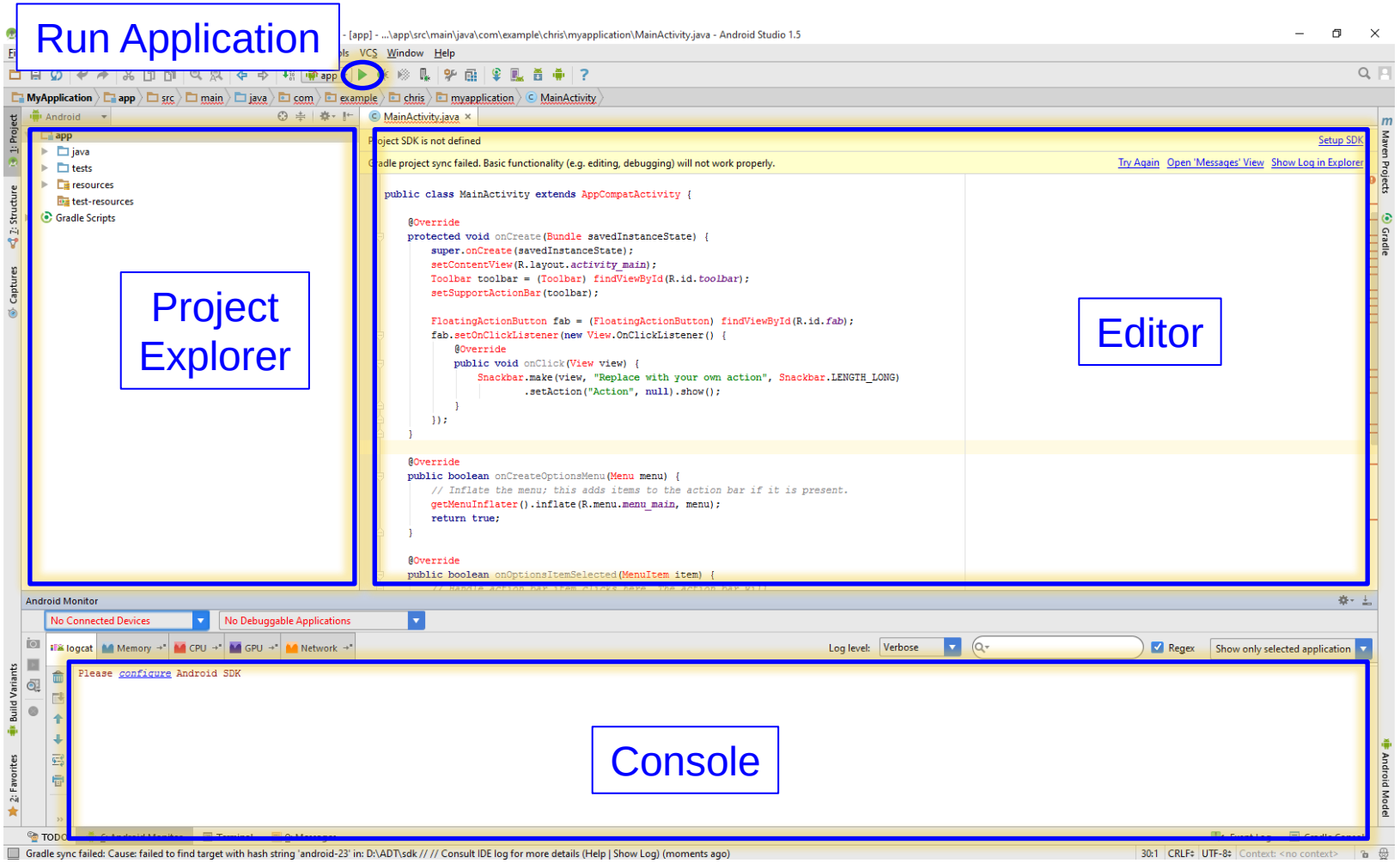
Displays the captured image

Text View

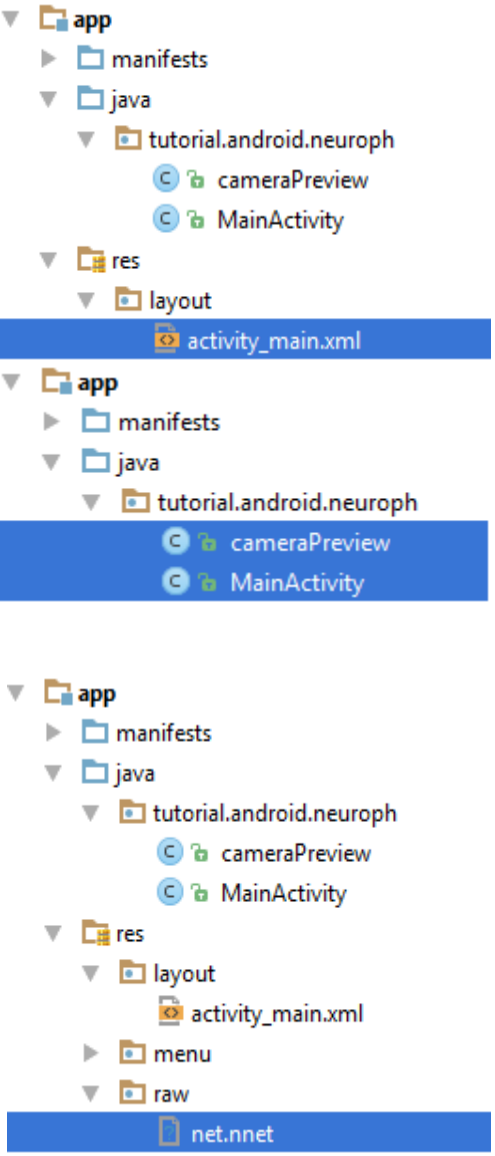
Displays the network output



Android Studio Overview



Components of The Android Application



- <Project Path>/app/manifests
  - Mandatory file for all android applications
  - Declares the activities to run
  - Supported Android Versions
  - Permissions (Camera, I/O)
- <Project Path>/app/res/layout/activity_main.xml
  - A layout defines the visual structure for a user interface, such as the UI
- <Project Path>/app/src/main/java/MainActivity.java
  - Contains the starting activity
  - Get control of UI objects
  - Start other activities
- <Project Path>/app/src/main/java/cameraPreview.java
  - Handles connectivity with camera and the processing necessary for the image processing and machine learning
- <Project Path>/app/res/raw/<network_name.nnet>
  - The folder that contains the neural network model