

REAL TIME VISION BASED HAND GESTURE IDENTIFICATION

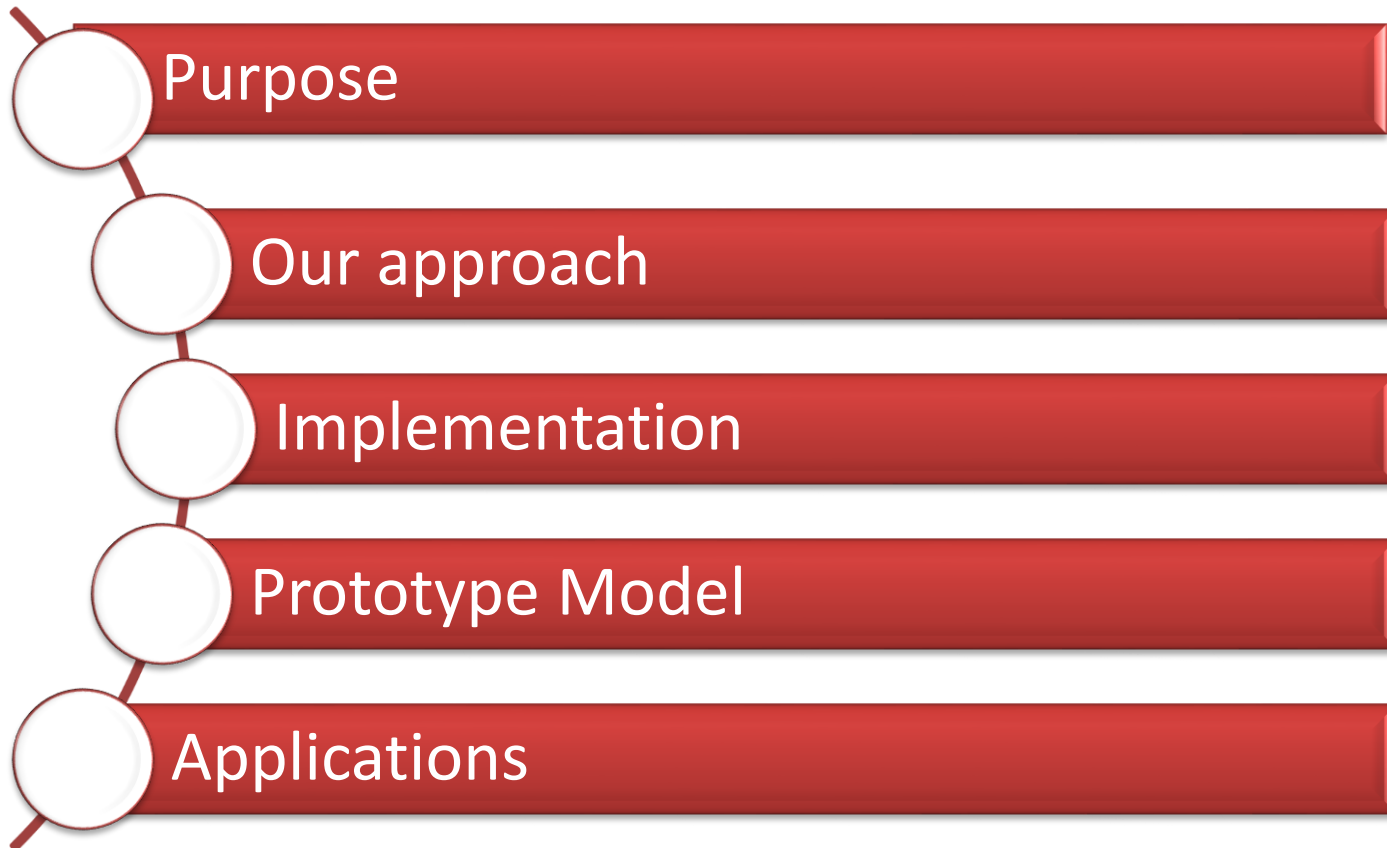


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CONTENTS



PURPOSE

- To interpret Static human hand gesture
- Webcam as an input (vision) device
- Implementation on MATLAB and Simulink as well
- MATLAB toolbox used
 - Image processing toolbox
 - Neural Network Toolbox
 - Arduino Hardware Support Package



OUR APPROACH



- Data Set Collection



- Image Processing



- Feature Extraction



- Classification



- Testing



- Hardware Implementation

OUR APPROACH



- **Data Set Collection**



- Image Processing



- Feature Extraction



- Classification



- Testing



- Hardware Implementation

Gestures

Up Gesture



Down Gesture



Left Gesture



Right Gesture



Stop Gesture



Blank Gesture



Data Set Collection

- Using a 5 megapixel webcam
- Black background
- Using red glove
- A data set of 252 images.
- 6 gestures with 42 images per gesture

OUR APPROACH



- Data Set Collection



- **Image Processing**



- Feature Extraction



- Classification



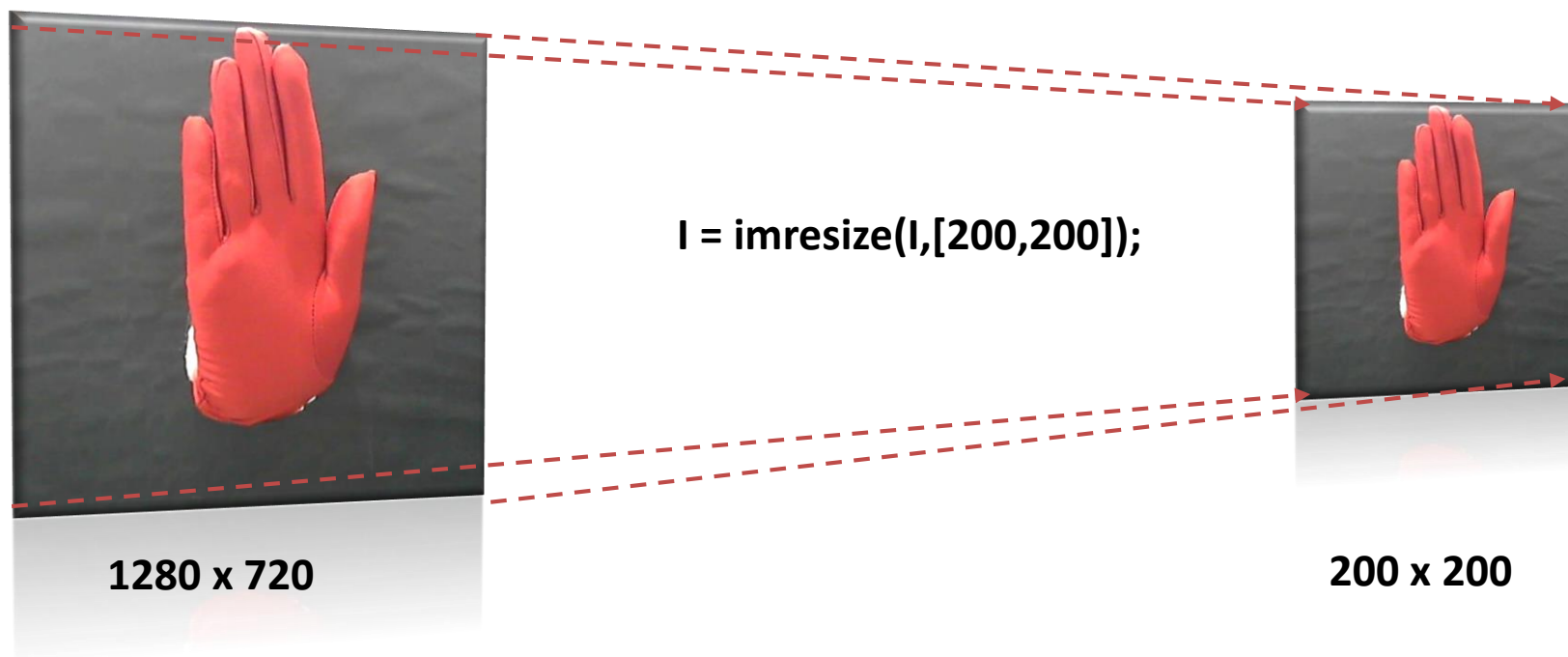
- Testing



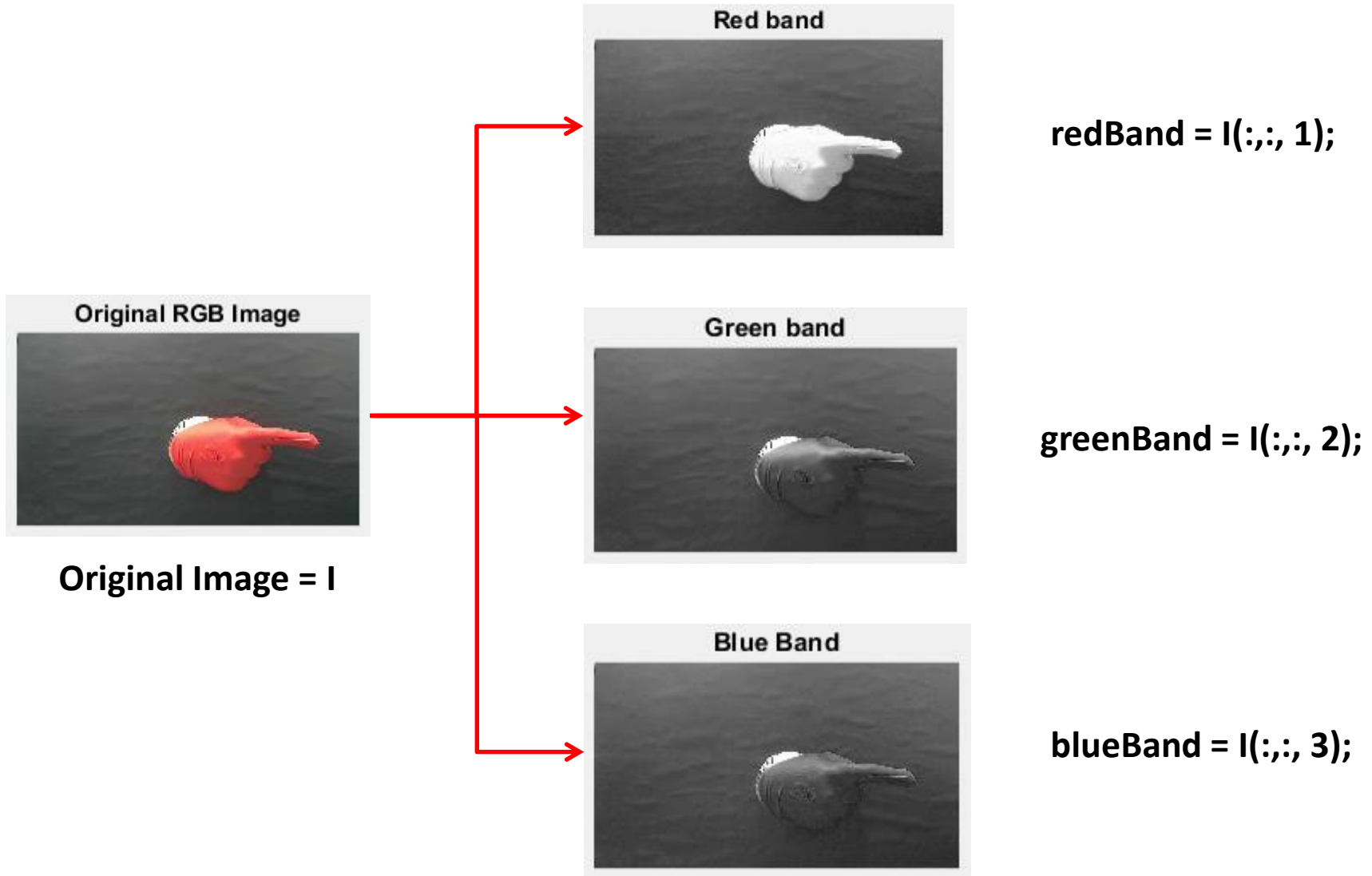
- Hardware Implementation

IMAGE PROCESSING

Image Resizing



Color Segmentation



OUR APPROACH



- Data Set Collection



- Image Processing



- **Feature Extraction**



- Classification



- Testing

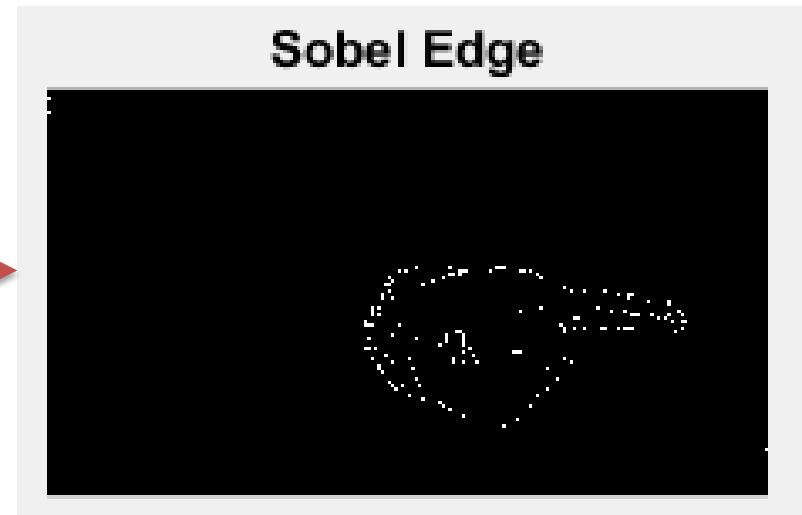
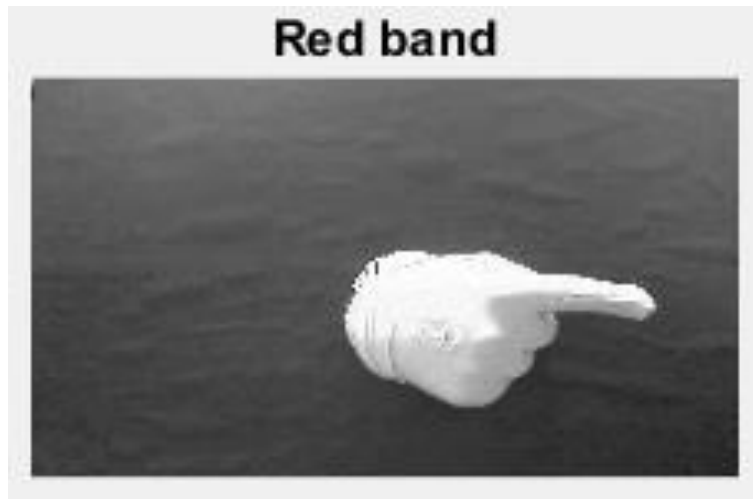


- Hardware Implementation

FEATURE EXTRACTION

Edge Detection

- Technique for finding the boundaries of objects within images
- Works by detecting discontinuities in frequency
- Three methods: Sobel, Canny, Fuzzy Logic



`I = edge(redBand,'sobel');`

OUR APPROACH



- Data Set Collection



- Image Processing



- Feature Extraction



- **Classification**



- Testing

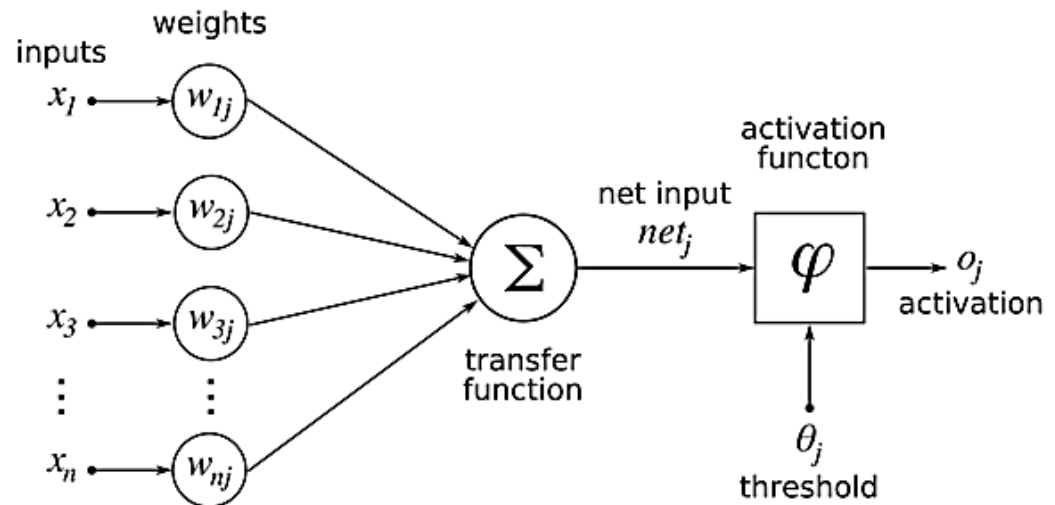


- Hardware Implementation

CLASSIFICATION

Neural Network

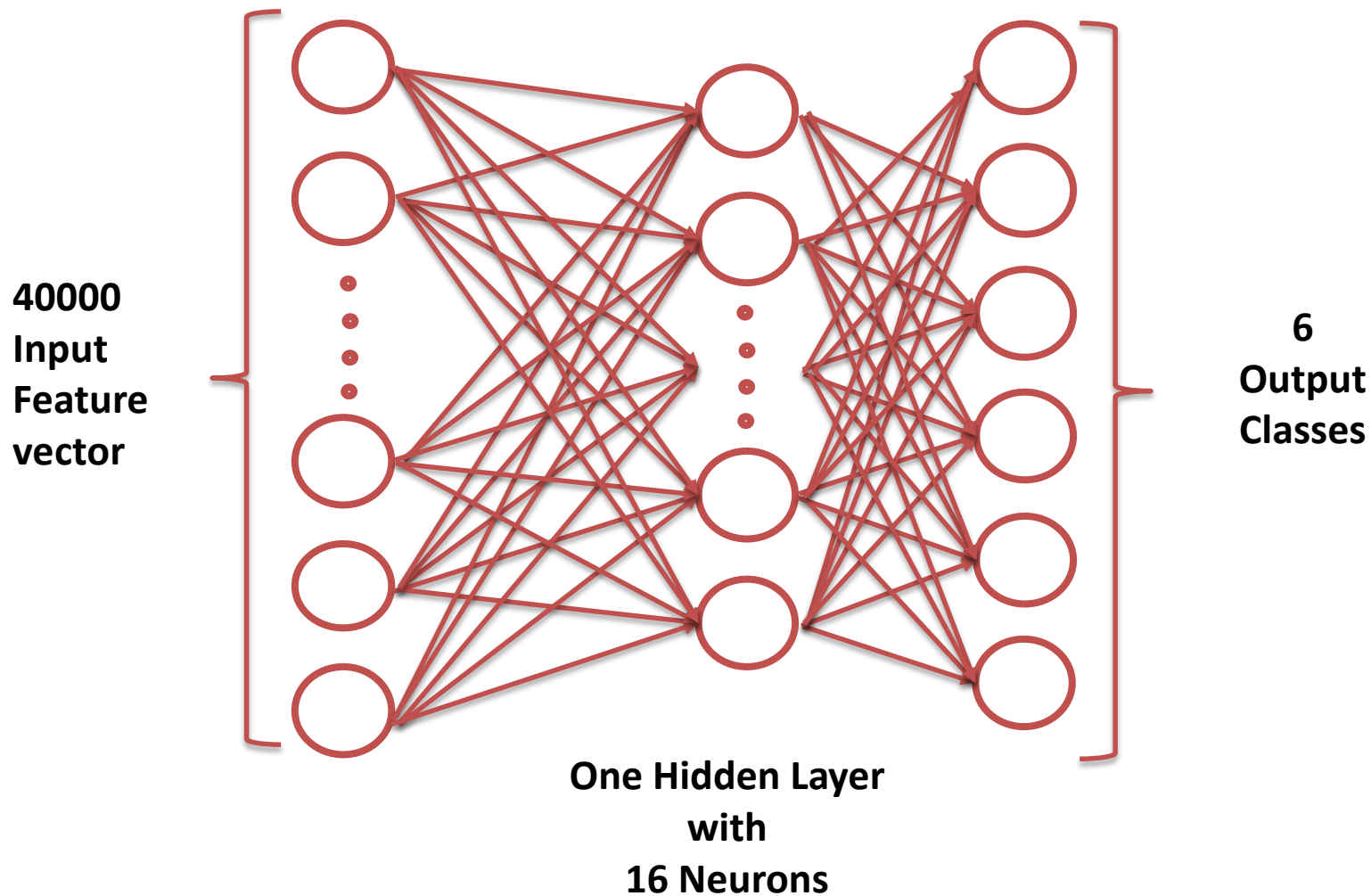
- Supervised learning algorithm, flexible enough to learn functional relationship
- Multilayer Perceptron – multiple neurons in input , output and hidden layer
- Optimized weights are calculated for every input –output combination
- Back propagation algorithm:
Error correction



Working of a single neuron

CLASSIFICATION

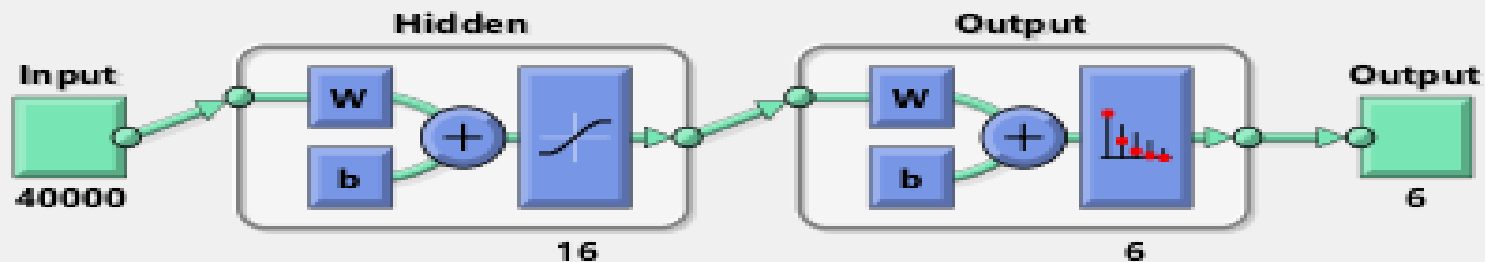
Three Layer Neural Network



CLASSIFICATION

Neural Network Toolbox

Neural Network









Progress

Epoch:	0	<div style="width: 7.7%;"><div style="width: 77 iterations;"></div></div>	1000
Time:		<div style="width: 14%;"><div style="width: 0:00:14;"></div></div>	
Performance:	0.454	<div style="width: 5.47%;"><div style="width: 0.00247;"></div></div>	0.00
Gradient:	11.3	<div style="width: 27.8%;"><div style="width: 0.0278;"></div></div>	1.00e-06
Validation Checks:	0	<div style="width: 100%;"><div style="width: 6;"></div></div>	6

CLASSIFICATION

Training Results

Results			
	 Samples	 CE	 %E
 Training:	176	1.38312e-0	0
 Validation:	38	4.42142e-0	2.63157e-0
 Testing:	38	4.46422e-0	10.52631e-0

- Training accuracy = 100%
- Validation accuracy = 97.37%
- Testing accuracy = 89.48%

OUR APPROACH



- Data Set Collection



- Image Processing



- Feature Extraction



- Classification



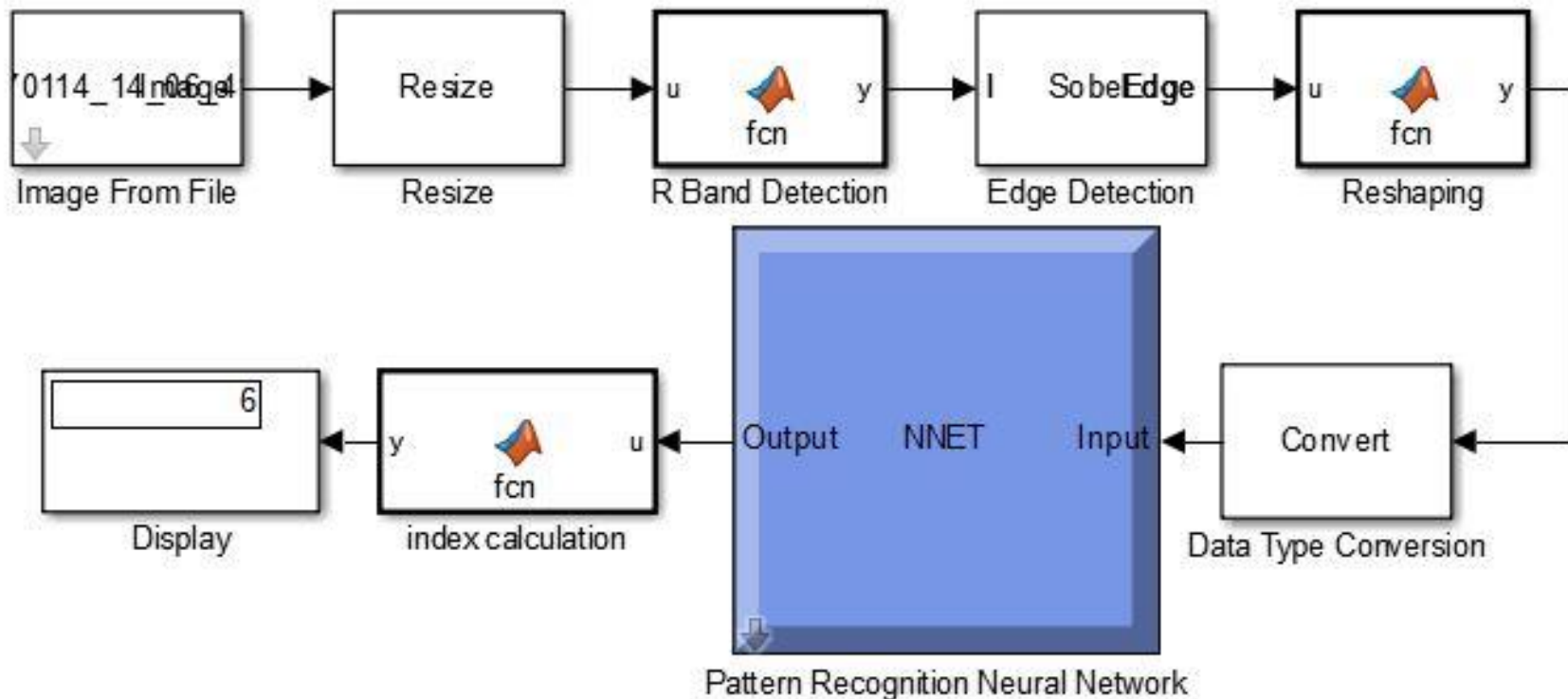
- **Testing**



- Hardware Implementation

Testing on Simulink

- Interactive environment for multi domain simulations
- Simple and easy interfacing with hardware



OUR APPROACH



- Data Set Collection



- Image Processing



- Feature Extraction



- Classification



- Testing



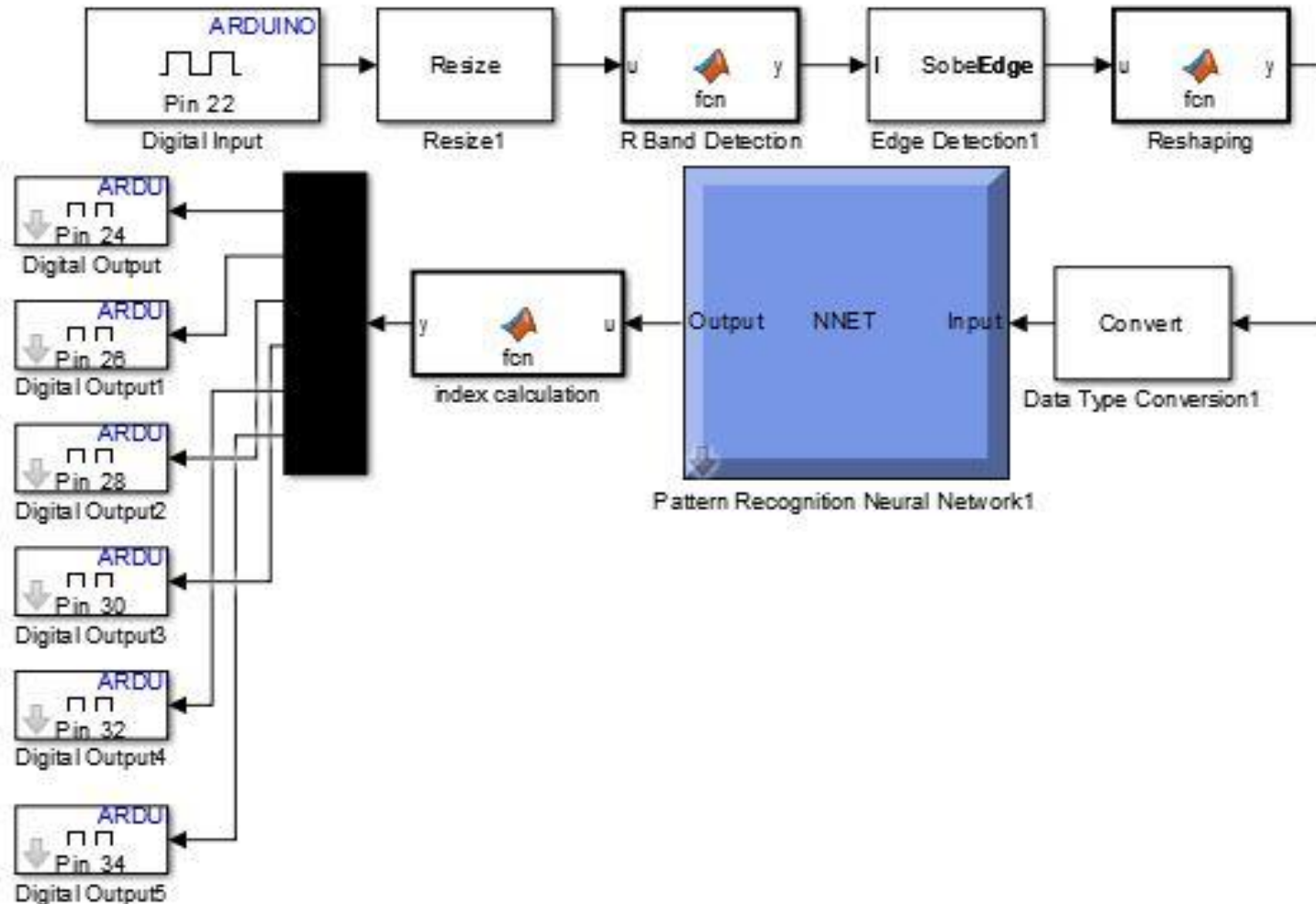
- **Hardware Implementation**

HARDWARE IMPLEMENTATION

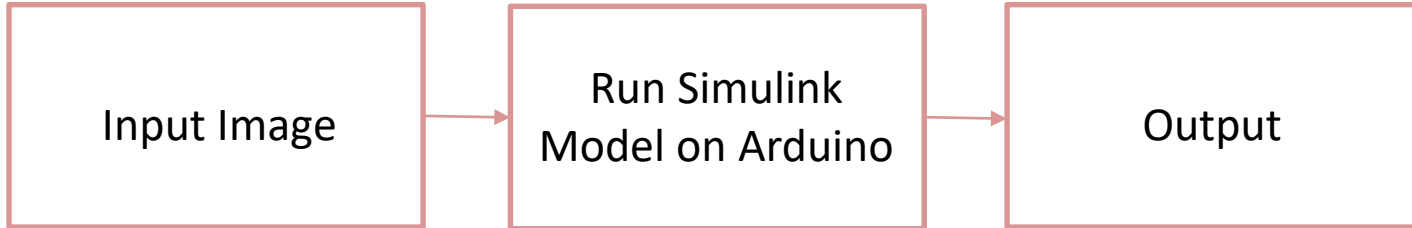
Using Arduino Uno Board

- MATLAB/Simulink Support Package for Arduino allows to communicate over USB to Arduino board
 - Support package includes a library of Simulink blocks for
 - Acquire analog and digital sensor data from Arduino board
 - Control other devices with digital and PWM outputs
 - Drive DC, servo, and stepper motors, etc
- Simulink Model is run on Arduino Hardware
 - Enables interactively monitor and tune algorithms developed in Simulink as they run on Arduino

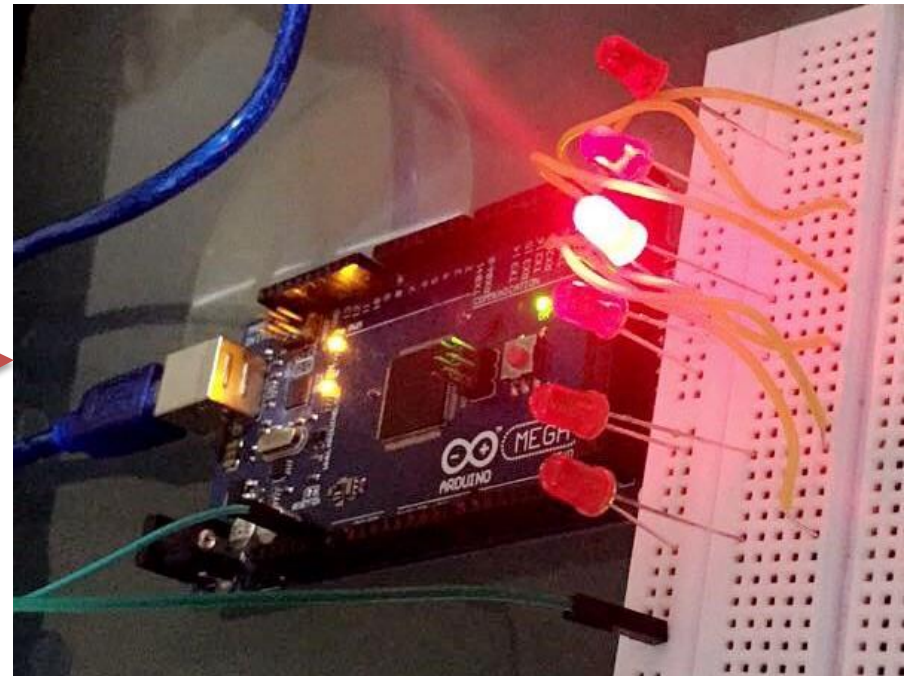
Communicating with Arduino Hardware



HARDWARE IMPLEMENTATION



Test Image



Output : Class - 3

APPLICATIONS

Gesture recognition can have applications in:

- Sign language interpretation for disabled
- Vehicle automation
- Computer games
- Virtual reality

and many more

REFERENCES

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