NFT REPORT

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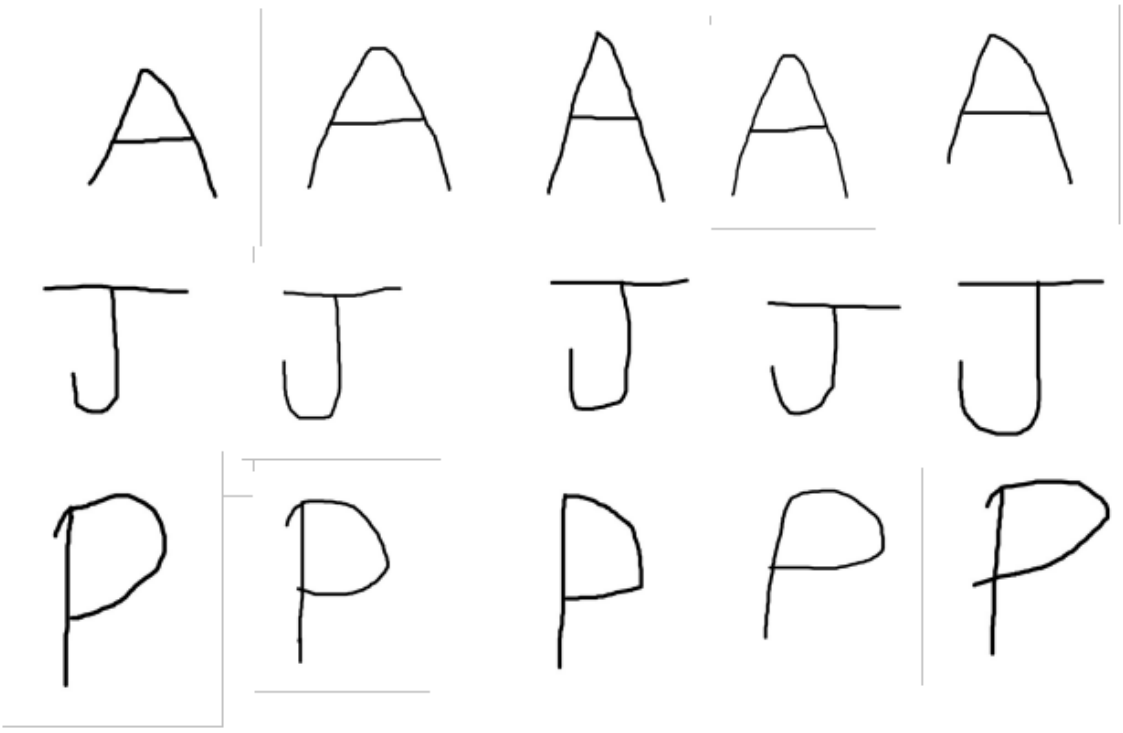
1. TRAINING INPUT IMAGES



2. INPUT FEATURE VECTOR

X[0, 3, 6, 9, 12] : a1.jpg, a2.jpg, a3.jpg, a4.jpg, a5.jpg
X[1, 4, 7, 10, 13] : j1.jpg, j2.jpg, j3.jpg, j4.jpg, j5.jpg
X[2, 5, 8, 11, 14] : p1.jpg, p2.jpg, p3.jpg, p4.jpg, p5.jpg,

DATASET:

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      1, 1, 1, 0, 0, 0, 1, 1, 1, 1, 1, 1]]
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3. ARCHITECTURE OF NN

A. Single Hidden Layer

- Input Layer Nodes : 100
- Hidden Layer Nodes : 70
- Output Layer Nodes : 3
- Number of Layers : 3
- Activation Function : Sigmoid

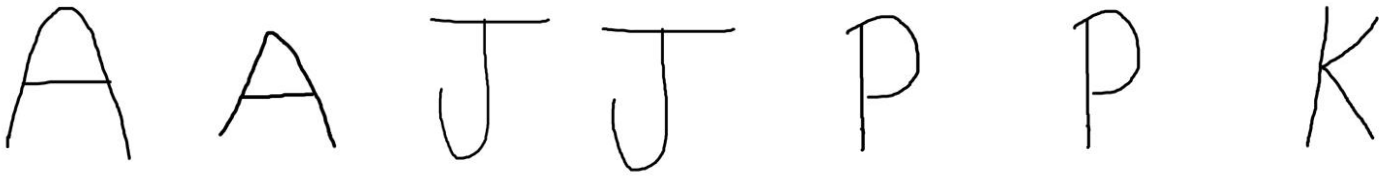
B. Double Hidden Layer

- Input Layer Nodes : 100
- 1st Hidden Layer Nodes : 70
- 2nd Hidden Layer Nodes: 40
- Output Layer Nodes : 3
- Number of Layers : 4
- Activation Function : Sigmoid

4. TRAINING RESULTS

Hidden Layers	Learning Rate	0.01	0.05	0.1	0.2	0.4	0.8
1	Epoch	Exceeded	1601	796	397	209	115
	Error Threshold	0.01	0.01	0.01	0.01	0.01	0.01
2	Epoch	Exceeded	Exceeded	3125	1557	805	410
	Error Threshold	0.01	0.01	0.01	0.01	0.01	0.01

5. TESTING INPUT IMAGES



6. INPUT FEATURE VECTORS

X[0, 3] : a6.jpg, a7.jpg
X[1, 4] : j6.jpg, j7.jpg
X[2, 5] : p6.jpg, p7.jpg
X[6] : k.jpg

DATASET:

```
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```

7. TEST RESULTS

A. Single Layer:

The network converges for all learning rates except 0.01, where it exceeds 10000 epochs. The network provides correct output for learning rates 0.8, 0.4. But it fails to recognise ‘A’ in the rest of the learning rates and.
Also, all the networks recognise the unknown character ‘K’ as ‘A’.
The overall accuracy is 27/35 = 0.7714.

Learning Rate: 0.8

Decimal output:[0.96383235 0.00161627 0.05295039] Resultant Output: [1, 0, 0] = A Expected Output: [1 0 0]
Decimal output:[0.00242409 0.98883673 0.01954979] Resultant Output: [0, 1, 0] = J Expected Output: [0 1 0]

Decimal output:[0.05628016 0.09531975 0.57299432] Resultant Output: [0, 0, 1] = P Expected Output: [0 0 1]
Decimal output:[0.98426766 0.01455007 0.00230652] Resultant Output: [1, 0, 0] = A Expected Output: [1 0 0]
Decimal output:[0.0032714 0.98739876 0.01458771] Resultant Output: [0, 1, 0] = J Expected Output: [0 1 0]
Decimal output:[0.06077277 0.01387381 0.91818323] Resultant Output: [0, 0, 1] = P Expected Output: [0 0 1]
Decimal output:[0.78500353 0.0211709 0.0027954] Resultant Output: [1, 0, 0] = A Expected Output: Ambiguous Character

Learning Rate: 0.4

Decimal output:[0.96026588 0.00218493 0.05835626] Resultant Output: [1, 0, 0] = A Expected Output: [1 0 0]
Decimal output:[0.00309782 0.98912805 0.02335655] Resultant Output: [0, 1, 0] = J Expected Output: [0 1 0]
Decimal output:[0.06431585 0.09332779 0.50991992] Resultant Output: [0, 0, 1] = P Expected Output: [0 0 1]
Decimal output:[0.98466096 0.01714938 0.00261752] Resultant Output: [1, 0, 0] = A Expected Output: [1 0 0]
Decimal output:[0.00460698 0.98750146 0.01650287] Resultant Output: [0, 1, 0] = J Expected Output: [0 1 0]
Decimal output:[0.06395717 0.0125142 0.90398134] Resultant Output: [0, 0, 1] = P Expected Output: [0 0 1]
Decimal output:[0.78426766 0.01455007 0.00230652] Resultant Output: [1, 0, 0] = A Expected Output: Ambiguous Character

Learning Rate: 0.2

Decimal output:[0.95969438 0.00216133 0.06076922] Resultant Output: [1, 0, 0] = A Expected Output: [1 0 0]
Decimal output:[0.00258601 0.9903132 0.0229278] Resultant Output: [0, 1, 0] = J Expected Output: [0 1 0]
Decimal output:[0.06186232 0.09515213 0.4936064] Resultant Output: [0, 0, 0] = Ambiguous Character Expected Output: [0 0 1]
Decimal output:[0.9843518 0.01783404 0.00237837] Resultant Output: [1, 0, 0] = A Expected Output: [1 0 0]
Decimal output:[0.00409762 0.98831132 0.0162425] Resultant Output: [0, 1, 0] = J Expected Output: [0 1 0]
Decimal output:[0.06518946 0.01197174 0.90151438] Resultant Output: [0, 0, 1] = P Expected Output: [0 0 1]

Decimal output:[0.75530624 0.00254445 0.06663124] Resultant Output: [1, 0, 0] = A Expected Output: Ambiguous Character

Learning Rate: 0.1

Decimal output:[0.95530624 0.00254445 0.06663124] Resultant Output: [1, 0, 0] = A Expected Output: [1 0 0]
Decimal output:[0.00249172 0.99018266 0.02803816] Resultant Output: [0, 1, 0] = J Expected Output: [0 1 0]
Decimal output:[0.06443637 0.0863458 0.48717355] Resultant Output: [0, 0, 0] = Ambiguous Character Expected Output: [0 0 1]
Decimal output:[0.98582523 0.02040083 0.00248358] Resultant Output: [1, 0, 0] = A Expected Output: [1 0 0]
Decimal output:[0.00434823 0.98804758 0.01886039] Resultant Output: [0, 1, 0] = J Expected Output: [0 1 0]
Decimal output:[0.06671725 0.01042733 0.89681589] Resultant Output: [0, 0, 1] = P Expected Output: [0 0 1]
Decimal output:[0.76383235 0.00161627 0.05295039] Resultant Output: [1, 0, 0] = A Expected Output: Ambiguous Character

Learning Rate: 0.05

Decimal output:[0.95440616 0.00289745 0.06572154] Resultant Output: [1, 0, 0] = A Expected Output: [1 0 0]
Decimal output:[0.00262148 0.99009556 0.02897262] Resultant Output: [0, 1, 0] = J Expected Output: [0 1 0]
Decimal output:[0.06433923 0.08373551 0.49014525] Resultant Output: [0, 0, 0] = Ambiguous Character Expected Output: [0 0 1]
Decimal output:[0.98500353 0.0211709 0.0027954] Resultant Output: [1, 0, 0] = A Expected Output: [1 0 0]
Decimal output:[0.00459256 0.98836112 0.01903811] Resultant Output: [0, 1, 0] = J Expected Output: [0 1 0]
Decimal output:[0.06667397 0.00957758 0.89611537] Resultant Output: [0, 0, 1] = P Expected Output: [0 0 1]
Decimal output:[0.72493518 0.00103394 0.05410369] Resultant Output: [1, 0, 0] = A Expected Output: Ambiguous Character

B. Multiple Layers:

The network converges for 4/6 learning rates while the other two exceed the time to reach epoch. The network provides correct output for all the known characters. But it recognises unknown ‘K’ as ‘A’.
The accuracy is given by 24/28 = 6/7 = 0.8571.

Learning Rate: 0.8

Decimal output: [0.97795538 0.00000002 0.01890936] Resultant Output: [1, 0, 0] = A Expected Output: [1 0 0]
Decimal output: [0.00281437 0.98528446 0.02030851] Resultant Output: [0, 1, 0] = J Expected Output: [0 1 0]
Decimal output: [0.01553338 0.01577331 0.94759728] Resultant Output: [0, 0, 1] = P Expected Output: [0 0 1]
Decimal output: [0.98215722 0.00000001 0.00965399] Resultant Output: [1, 0, 0] = A Expected Output: [1 0 0]
Decimal output: [0.00283588 0.98458601 0.02123822] Resultant Output: [0, 1, 0] = J Expected Output: [0 1 0]
Decimal output: [0.04911123 0.00048486 0.98392141] Resultant Output: [0, 0, 1] = P Expected Output: [0 0 1]
Decimal output: [0.78275824 0.02160189 0.00853508] Resultant Output: [1, 0, 0] = A Expected Output: Ambiguous Character

Learning Rate: 0.4

Decimal output: [0.97787191 0.00000003 0.01895266] Resultant Output: [1, 0, 0] = A Expected Output: [1 0 0]
Decimal output: [0.00270654 0.98537457 0.01972711] Resultant Output: [0, 1, 0] = J Expected Output: [0 1 0]
Decimal output: [0.01557501 0.01674778 0.94900724] Resultant Output: [0, 0, 1] = P Expected Output: [0 0 1]
Decimal output: [0.98192778 0.00000003 0.00988684] Resultant Output: [1, 0, 0] = A Expected Output: [1 0 0]
Decimal output: [0.00272911 0.98464033 0.02069847] Resultant Output: [0, 1, 0] = J Expected Output: [0 1 0]
Decimal output: [0.0497948 0.0005725 0.98328568] Resultant Output: [0, 0, 1] = P Expected Output: [0 0 1]
Decimal output: [0.72549814 0.23910189 0.01429829] Resultant Output: [1, 0, 0] = A Expected Output: Ambiguous Character

Learning Rate: 0.2

Decimal output: [0.97753051 0.00000006 0.02000645] Resultant Output: [1, 0, 0] = A Expected Output: [1 0 0]
Decimal output: [0.00303168 0.98394057 0.02054345] Resultant Output: [0, 1, 0] = J Expected Output: [0 1 0]
Decimal output: [0.01566964 0.02029676 0.93972366] Resultant Output: [0, 0, 1] = P Expected Output: [0 0 1]
Decimal output: [0.98269436 0.00000006 0.0089154] Resultant Output: [1, 0, 0] = A Expected Output: [1 0 0]
Decimal output: [0.00305321 0.98326553 0.02136666] Resultant Output: [0, 1, 0] = J Expected Output: [0 1 0]
Decimal output: [0.04654977 0.0008544 0.98032574] Resultant Output: [0, 0, 1] = P Expected Output: [0 0 1]
Decimal output: [0.79848159 0.24848419 0.02156461] Resultant Output: [1, 0, 0] = A Expected Output: Ambiguous Character

Learning Rate: 0.1

Decimal output: [0.97725706 0.00000009 0.01982502] Resultant Output: [1, 0, 0] = A Expected Output: [1 0 0]
Decimal output: [0.00332004 0.98319762 0.02063127] Resultant Output: [0, 1, 0] = J Expected Output: [0 1 0]
Decimal output: [0.01583011 0.02274743 0.93290598] Resultant Output: [0, 0, 1] = P Expected Output: [0 0 1]
Decimal output: [0.98275824 0.00000009 0.00853508] Resultant Output: [1, 0, 0] = A Expected Output: [1 0 0]
Decimal output: [0.00334096 0.98253115 0.02142098] Resultant Output: [0, 1, 0] = J Expected Output: [0 1 0]
Decimal output: [0.04391981 0.00109861 0.97843701] Resultant Output: [0, 0, 1] = P Expected Output: [0 0 1]
Decimal output: [0.71485626 0.26431959 0.00748651] Resultant Output: [1, 0, 0] = A Expected Output: Ambiguous Character