

## 1 DQN

### a. Hyperparameter tuning parameter range

|                    |       |        |        |     |     |    |
|--------------------|-------|--------|--------|-----|-----|----|
| Gamma              | 0.999 | 0.6    | 0.3    | -   | -   | -  |
| Learning Rate      | 0.001 | 0.0001 | 0.0005 | -   | -   | -  |
| Target Update      | 5     | 10     | 20     | -   | -   | -  |
| Number of Episodes | 300   | 500    | 700    | -   | -   | -  |
| Batch Size         | 32    | 64     | 128    | 256 | 512 | -  |
| Epsilon Decay      | 100   | 200    | 300    | -   | -   | -  |
| Epsilon End        | 0.01  | 0.05   | 0.1    | -   | -   | -  |
| Epsilon Start      | 0.99  | 0.9    | 0.7    | -   | -   | -  |
| Layer One Nodes    | 5     | 10     | 16     | 20  | 32  | 64 |
| Layer Two Nodes    | 10    | 20     | 32     | 64  | 128 | -  |

### b. Selected hyperparameters after 13 model runs

|                    |        |
|--------------------|--------|
| Gamma              | 0.999  |
| Learning Rate      | 0.0001 |
| Target Update      | 10     |
| Number of Episodes | 900    |
| Batch Size         | 32     |
| Epsilon Decay      | 200    |
| Epsilon End        | 0.01   |
| Epsilon Start      | 0.99   |
| Layer One Nodes    | 32     |
| Layer Two Nodes    | 128    |

### c. Model setup

|              |                                                          |
|--------------|----------------------------------------------------------|
| Layer One    | 2D convolutional layer,<br>kernel size of 3, stride of 2 |
| Dropout      | 2D Batch Norm                                            |
| Activation   | ReLU                                                     |
| Layer Two    | 2D convolutional layer,<br>kernel size of 3, stride of 2 |
| Dropout      | 2D Batch Norm                                            |
| Activation   | ReLU                                                     |
| Layer Two    | 2D convolutional layer,<br>kernel size of 3, stride of 2 |
| Dropout      | 2D Batch Norm                                            |
| Activation   | ReLU                                                     |
| Output Layer | fully connected size 30                                  |

## 2 ResNET

### a. Hyperparameter tuning parameter range

|                    |           |           |           |            |
|--------------------|-----------|-----------|-----------|------------|
| Number of Episodes | 50        | 100       | 200       | 300        |
| Learning Rate      | 0.001     | 0.0001    | 0.0005    | -          |
| Layer One Nodes    | ResNet 18 | ResNet 34 | ResNet 50 | ResNet 101 |

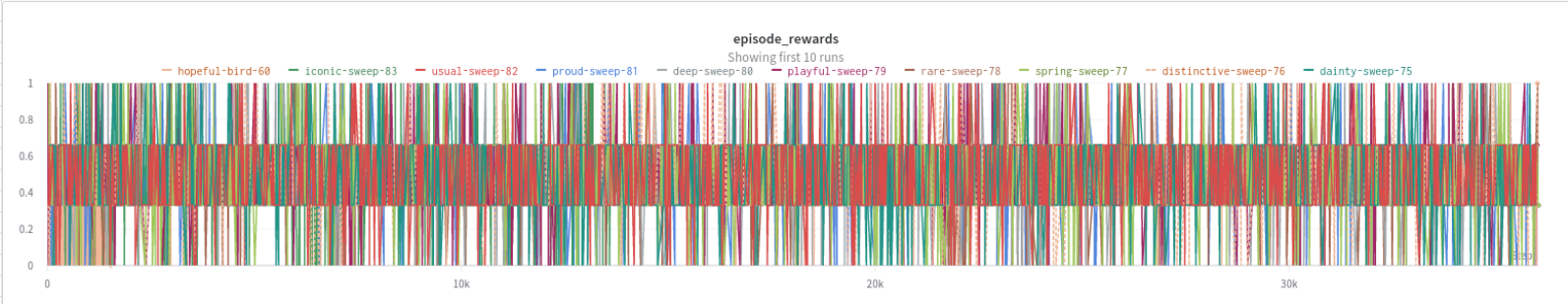
### b. Selected hyperparameters after 13 model runs

|                    |           |
|--------------------|-----------|
| Number of Episodes | 100       |
| Learning Rate      | 0.0001    |
| Layer One Nodes    | ResNet 18 |

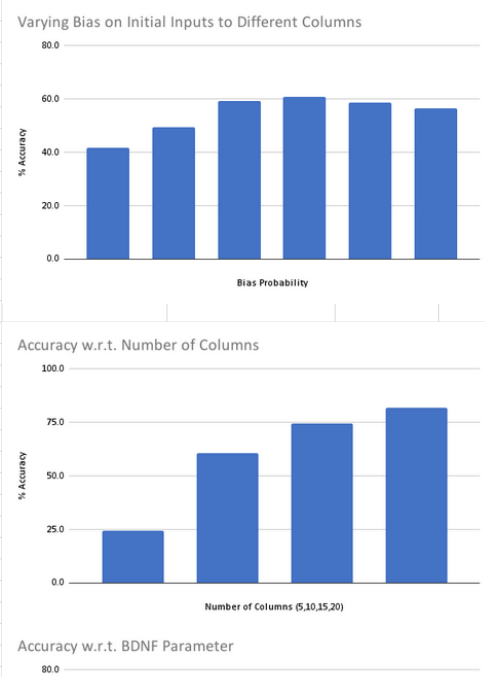
|                  |                                                     |                         |
|------------------|-----------------------------------------------------|-------------------------|
| c.               | <b>Model setup</b>                                  |                         |
|                  | All Layers                                          | resnet18                |
|                  | Output Layer                                        | fully connected size 30 |
| <b>3 E-SARSA</b> |                                                     |                         |
| a.               | <b>Hyperparameter tuning parameter range</b>        |                         |
|                  | Alpha                                               |                         |
|                  | Epsilon Start                                       |                         |
|                  | Epsilon End                                         |                         |
|                  | Epsilon Decay                                       |                         |
|                  | Gamma                                               |                         |
|                  | Number of Episodes                                  |                         |
| b.               | <b>Selected hyperparameters after 13 model runs</b> |                         |
|                  | Alpha                                               |                         |
|                  | Epsilon Start                                       |                         |
|                  | Epsilon End                                         |                         |
|                  | Epsilon Decay                                       |                         |
|                  | Gamma                                               |                         |
|                  | Number of Episodes                                  |                         |
| <b>4 RA</b>      |                                                     |                         |
| a.               | <b>Model parameter configuration</b>                |                         |
|                  | Accuracy on Test                                    | 77.40% 89.80%           |
|                  | Columns                                             | 15 20                   |
|                  | Layer one neurons                                   | 10 20                   |
|                  | Branches per layer one neuron                       | 50 50                   |
|                  | Inputs per layer one neuron branch                  | 20 20                   |
|                  | Layer two neurons                                   | 10 10                   |
|                  | Branches per layer two neuron                       | 10 10                   |
|                  | Inputs per layer two neuron branch                  | 15 15                   |
|                  | Layer three neurons                                 | 10 10                   |
|                  | Branches per layer three neuron                     | 10 10                   |
|                  | Inputs per layer three neuron branch                | 15 15                   |
|                  | Cortical synapses                                   | 195000 460000           |
|                  | Basal Ganglia synapses                              | 450 600                 |
|                  | Total synapses                                      | 195450 460600           |
| b.               | <b>Split learning model parameter configuration</b> |                         |
|                  | Columns                                             | 15                      |
|                  | Layer one neurons                                   | 10                      |
|                  | Branches per layer one neuron                       | 50                      |
|                  | Inputs per layer one neuron branch                  | 20                      |
|                  | Layer two neurons                                   | 10                      |
|                  | Branches per layer two neuron                       | 10                      |
|                  | Inputs per layer two neuron branch                  | 15                      |

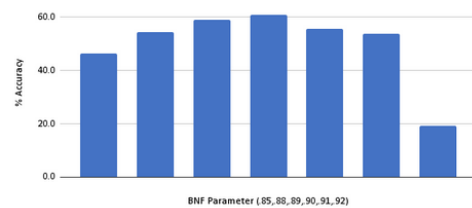
|                                      |        |
|--------------------------------------|--------|
| Layer three neurons                  | 1      |
| Branches per layer three neuron      | 10     |
| Inputs per layer three neuron branch | 15     |
| Cortical synapses                    | 174750 |
| Basal Ganglia synapses               | 450    |
| Total synapses                       | 175200 |
| Number of Learning Episodes          | 1650   |

5 DQN with working memory training accuracy for only 6 categories for four different runs. This model failed to learn.



6 RA results on 200 category identification tasks, with varied recommendation weights.





Accuracy w.r.t. Weight Reduction Factor

