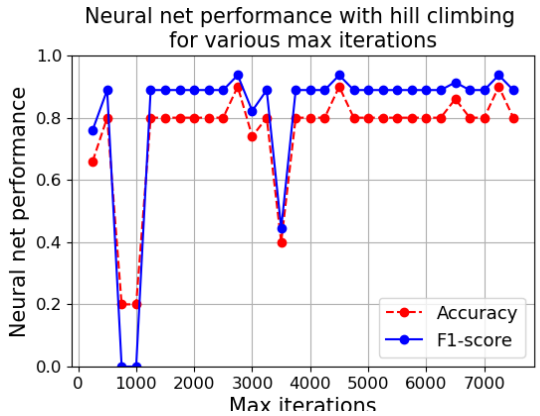
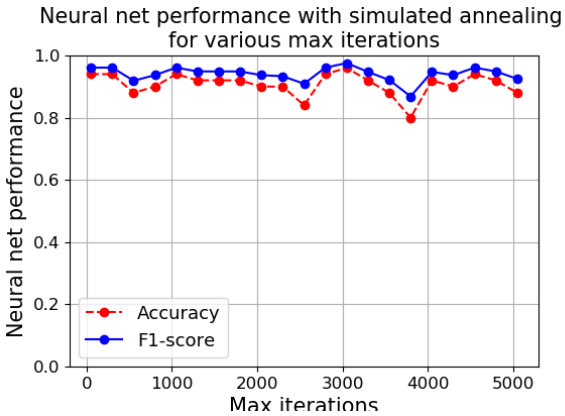
Objective:

To use eagle strategy, which allows for a range of algorithms to be implemented while moving from explore to exploit, for updating the weights of the neural network, without using back propagation.

Implementation:

Two models(strategies) are used for comparison.





Model-1:

The order of algorithms used is:

1. Simulated Annealing
2. Random Hill Climbing

Output for Model-1:

```
Model-1
The order of algorithms used is:
1. Simulated Annealing
2. Random Hill Climbing
Confusion Matrix:
 [[10  0]
 [ 3 37]]
Accuracy: 0.94
Execution time in seconds: 0:00:00.205487
```

Weights that will be passed as initial guess to Random Hill Climb Algorithm:

[1.90957729 -0.95665239 1.53543018 -3.53945874 5.8104694 -8.28485296
 -0.28492826 0.88977143 2.26347555 2.55060482 -0.04182845 1.04354447
 -3.98219744 -4.2605933   0.23777996 -8.57112215 9.63690818 0.76356725
 -6.09016808 -4.10773993 2.01545733 7.49241802 -1.31105237 7.85388806
 -9.56964499 4.37151313 -1.1749105   2.95136339 -9.44064725 -7.15311625
 -0.16673744 -8.57798664 1.73302221 1.57860117 -8.43232365 -7.6353991
 -0.21992201 -8.2822455 -9.72072345 0.90161903 -4.28827305 -4.16679149
  2.51902201 1.43279619 4.33187493 -9.01011203 -2.00373209 -0.01776004
  5.93723354 0.95493946 1.13439475 -9.32259085 3.74032623 0.49243874
  8.49405518 -4.60856211]

Final Weights:

[1.90957729 -0.95665239 1.53543018 -3.53945874 5.8104694 -8.28485296
 -0.28492826 0.88977143 2.26347555 2.55060482 -0.04182845 1.04354447
 -3.98219744 -4.2605933   0.23777996 -8.57112215 9.63690818 0.76356725
 -6.09016808 -4.10773993 2.01545733 7.49241802 -1.31105237 7.85388806
 -9.56964499 4.37151313 -1.1749105   2.95136339 -9.44064725 -7.15311625
 -0.16673744 -8.57798664 1.73302221 1.57860117 -8.43232365 -7.6353991
 -0.21992201 -8.2822455 -9.72072345 0.90161903 -4.28827305 -4.16679149
  2.51902201 1.43279619 4.33187493 -9.01011203 -2.00373209 -0.01776004
  5.93723354 0.95493946 1.13439475 -9.78872039 3.74032623 0.49243874
  8.49405518 -4.60856211]

Performance Metrics for Model-1:

- Accuracy of anneal classification: 0.94
- F1 score of anneal classification: 0.961038961038961

- Accuracy of the overall classification: **0.94**
- F1 score of overall classification: 0.961038961038961

- Execution time in seconds: 0:00:00.234316 s

Model-2:

The order of algorithms used is:
1. Random Hill Climbing
2. Simulated Annealing

Output for Model-2:

```
Model-2
The order of algorithms used is:
1. Random Hill Climbing
2. Simulated Annealing
Confusion Matrix:
 [[10  0]
 [ 4 36]]
Accuracy: 0.92
Execution time in seconds: 0:00:00.777925
```

Weights that will be passed as initial guess to simulated annealing:

[-5.92756226 -9.21188824 0.05849968 -7.57477641 -8.72672064 -5.43631983
  4.66480612 -9.11632109 0.76777528 -6.45472726 1.09652036 -8.73986858
 -2.27188862 0.82875708 1.71078101 -7.13511593 1.80393239 -0.26059281
 -1.26255504 -7.34312401 0.70315433 1.95978459 2.91231239 -4.01202049
 -3.4746214 -0.54245393 0.22441211 -0.11541267 -4.32237005 -9.54704393
 -0.08813741 2.40119538 2.06530519 -0.43007835 -0.75489985 -3.11589912
  1.56018132 4.94066247 -4.88107304 0.45446218 -4.88070053 -3.49193485
 -1.49808593 1.40406379 3.66504777 4.8613653   4.15731949 1.5182647
  0.76261083 1.23303994 -0.98081367 -6.72386924 -6.97555908 -1.88734146
  5.58925529 9.50303027]

Final Weights:

[-7.81606677 -6.9331557   3.51922562 1.3010045 -4.63749588 -7.15077525
 -0.48662117 -0.61541751 -8.17287874 7.57406925 -1.03079747 -5.06316515
  8.88905864 4.52498306 -3.66338257 1.53068077 3.39623381 -6.48611552
 -8.30678284 9.10372368 5.18345563 -5.45129483 2.7992753   6.20943676
 -3.51788532 -9.7891106 -7.49487235 9.54555101 0.75123894 -0.22387597
  3.1779506   7.47254527 5.45234954 2.36479356 -0.22791149 4.84089693
  9.76144392 5.82283774 9.03367822 2.82411286 -1.92237994 2.02134645
 -7.80198422 -8.64264405 -6.73927993 -4.54094384 -3.32336588 -8.34852253
  3.58911454 3.13968967 -3.88625405 8.77458975 9.90778991 6.08792864
 -9.57969288 -9.91926922]

<u>Performance Metrics of Model-2:</u>

- Accuracy of random hill climbing classification: 0.88
- F1 score of classification: 0.925

- Accuracy of the overall classification: **0.98**
- F1 score of classification: 0.925

- Execution time in seconds: 0:00:00.777925