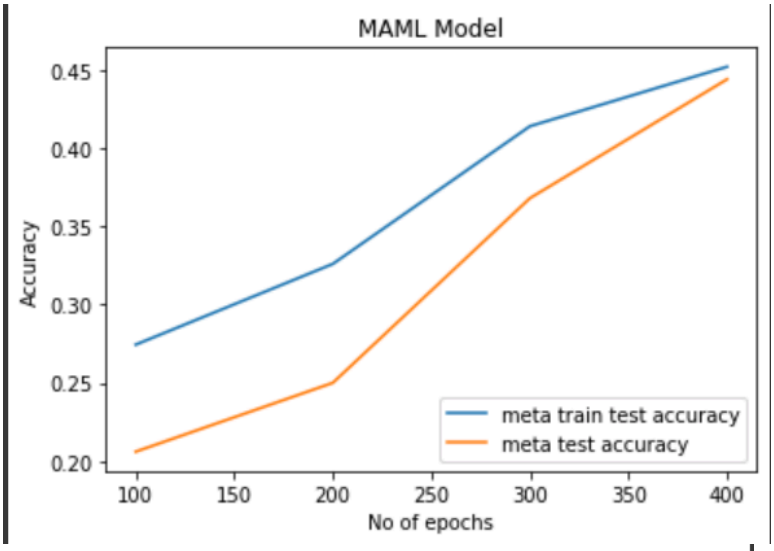
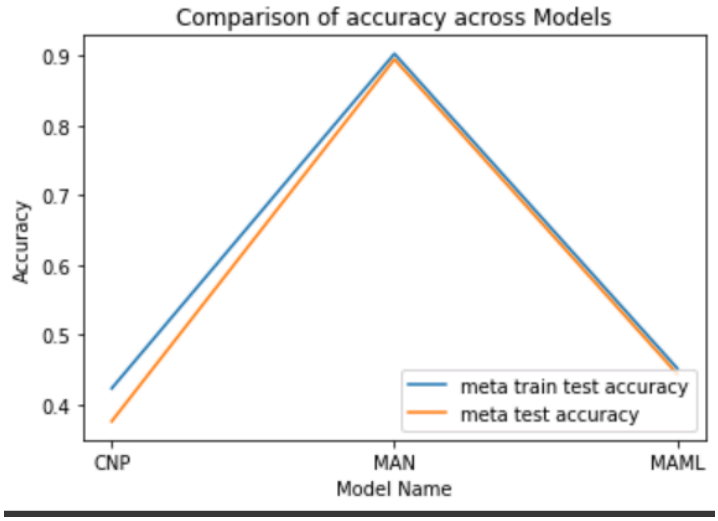
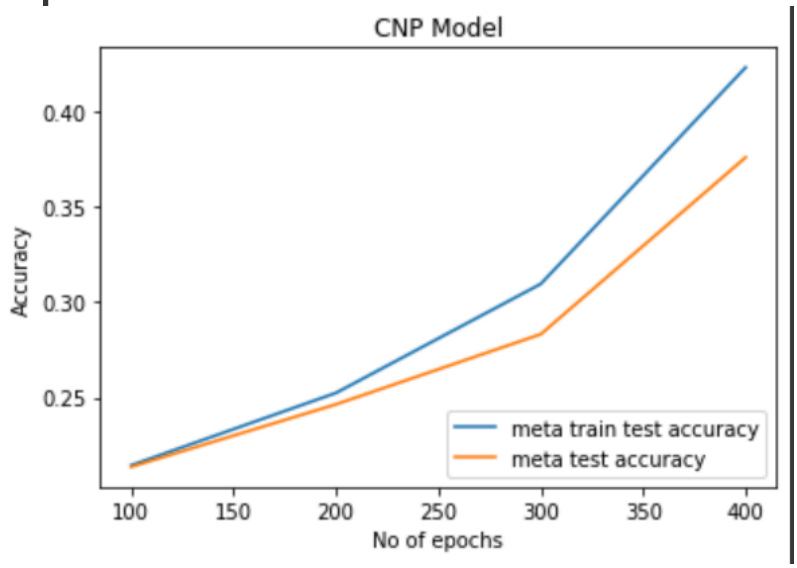
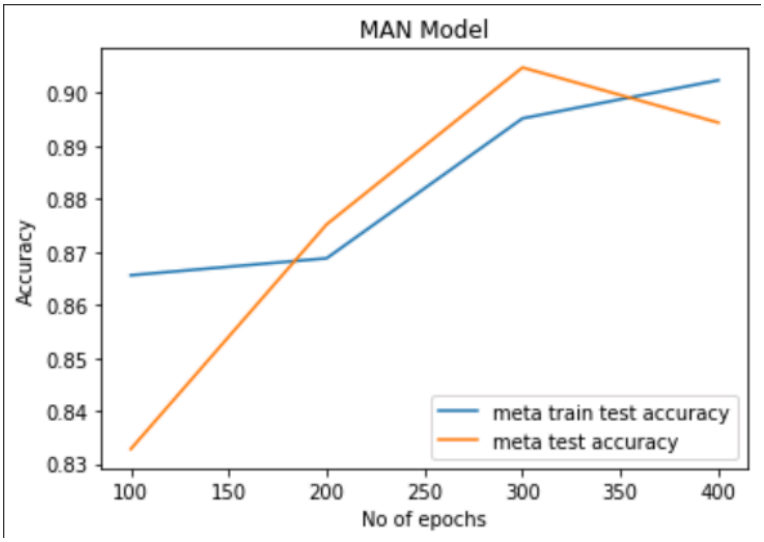
# Meta Learning(COL870)
# Homework-2

| | No of epochs | Training time | Loss | Accuracy | Meta-test accuracy |
|---|---|---|---|---|---|
| CNP | 100 | 39.365 | 1.60829 | 0.21440 | 0.21360 |
| | 200 | 15.801 | 1.60041 | 0.2524 | 0.2464 |
| | 300 | 15.406 | 1.53586 | 0.30960 | 0.28320 |
| | 400 | 15.708 | 1.38375 | 0.42320 | 0.37600 |
| | 500 | 15.719 | 1.24858 | 0.47040 | 0.41280 |
| | 600 | 15.433 | 1.15335 | 0.4808 | 0.46640 |
| | | | | | |
| MAN | 100 | 87.252 | -2.77737E-01 | 0.86560 | 0.83280 |
| | 200 | 67.137 | -3.02996E-01 | 0.86880 | 0.87520 |
| | 300 | 66.205 | -3.25444E-01 | 0.89520 | 0.90480 |
| | 400 | 66.865 | -3.35926E-01 | 0.90240 | 0.89440 |
| | | | | | |
| MAML | 100 | 65.38 | 1.58856 | 0.27440 | 0.20600 |
| | 200 | 19.583 | 1.55077 | 0.32600 | 0.25000 |
| | 300 | 17.536 | 1.49563 | 0.41400 | 0.36800 |
| | 400 | 19.282 | 1.31495 | 0.45200 | 0.444 |
| | 500 | 17.787 | 1.08509 | 0.58800 | 0.58600 |



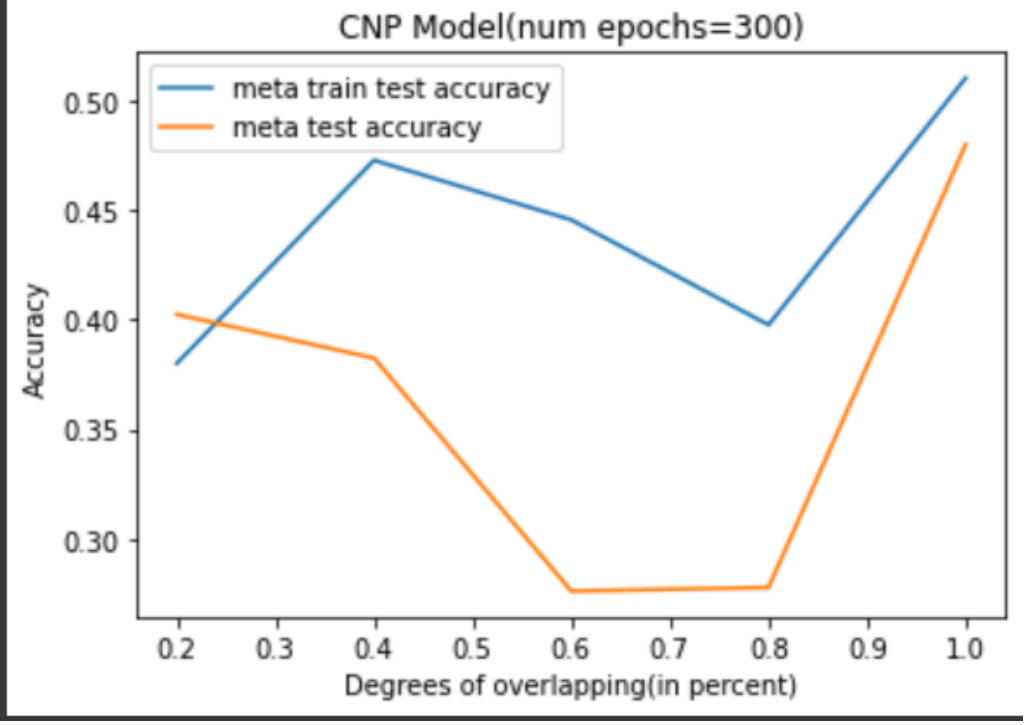

Observations:

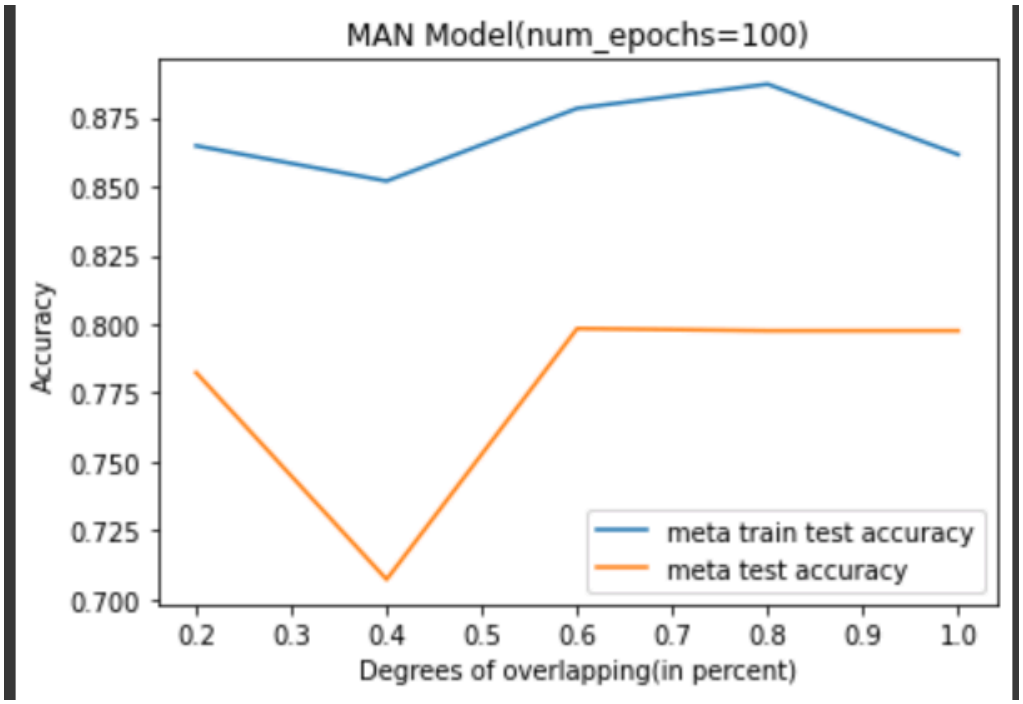
1) In the first 100 epochs time taken is usually much more than the subsequent 100 epochs for the three models.
2) Training time of MAN>MAML>CNP
3) With increasing number of models, accuracy increases as expected.

Comparison of training efficiency and performance accuracy at different degrees of overlap:
**num_epochs=300**

| | Degree of overlap | Training time | Loss | Accuracy | Meta-test accuracy |
|---|---|---|---|---|---|
| CNP | 20 | 67.995 | 1.4668 | 0.38000 | 0.40240 |
| | 40 | 71.075 | 1.4067 | 0.4728 | 0.38240 |
| | 60 | 72.947 | 1.41010 | 0.44560 | 0.27600 |
| | 80 | 72.681 | 1.4518 | 0.39760 | 0.27760 |
| | 100 | 71.127 | 1.4019 | 0.51040 | 0.48000 |
| Num_epochs=100 | | | | | |
| MAN | 20 | 87.684 | -0.304315 | 0.86480 | 0.78240 |
| | 40 | 86.603 | -3.00815E-01 | 0.85200 | 0.70720 |
| | 60 | 88.366 | -3.01542E-01 | 0.87840 | 0.79840 |
| | 80 | 91.489 | -3.05720E-01 | 0.88720 | 0.79760 |
| | | 87.767 | -2.94480E-01 | 0.86160 | 0.7976 |

Observation:
1)With increasing number of overlap, I expected the gap between meta train test accuracy and meta test accuracy would decrease. The plots show a bit of random nature on the contrary.


CNP Model(num epochs=300)
meta train test accuracy
meta test accuracy
Accuracy
0.50
0.45
0.40
0.35
0.30
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Degrees of overlapping(in percent)


MAN Model(num_epochs=100)
Accuracy
0.875
0.850
0.825
0.800
0.775
0.750
0.725
0.700
meta train test accuracy
meta test accuracy
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Degrees of overlapping(in percent)