

Assignment 2

Task 1:

- Neural networks..... Generative
- Naive Bayes classifier..... Discriminative
- Logistic regression..... Generative
- Gaussian Mixture model..... Generative
- GANs..... Generative
- LDA(Latent Dirichlet Allocation)..... Generative
- SVM..... Discriminative
- Decision Tree..... Discriminative

Task 2:

Transition Matrix:

```
array([[ 5.91780902e-03,  6.26468480e-01,  2.39835852e-01,
        6.47155209e-02,  9.09250508e-03,  1.27499890e-02,
        1.75047182e-02,  6.43717174e-04,  2.01161617e-03,
        9.89715155e-03,  9.76548213e-03,  1.39715887e-03],
       [ 1.55527916e-02,  1.49845165e-01,  1.29375590e-02,
        1.59437999e-01,  2.45189905e-01,  2.84527817e-01,
        2.64587125e-02,  5.98767886e-02,  1.78871693e-02,
        1.98495056e-02,  8.10466766e-03,  3.31919333e-04],
       [ 5.85278276e-03,  6.53058049e-01,  5.69239976e-02,
        1.74745661e-02,  8.84739677e-02,  1.00371035e-01,
        9.64691801e-03,  3.76181927e-02,  1.92938360e-02,
        3.80610413e-03,  6.98982645e-03,  4.90724117e-04],
       [ 1.63020222e-01,  9.76256048e-02,  5.75714019e-02,
        1.84405139e-01,  1.69274405e-01,  8.06515323e-02,
        1.03320203e-01,  1.43846213e-02,  6.56305204e-02,
        5.49545200e-02,  8.98078759e-03,  1.81042144e-04],
       [ 4.55622080e-01,  2.58494549e-01,  8.26925074e-02,
        4.12597335e-02,  2.02941685e-02,  9.74563073e-03,
        1.54905693e-02,  1.88960028e-03,  1.42308358e-02,
        6.96937186e-02,  3.01367019e-02,  4.49904828e-04],
       [ 1.09322220e-01,  1.33899978e-01,  4.66988375e-02,
        1.23645536e-01,  1.05220443e-01,  1.73162974e-01,
        7.03443738e-02,  1.11899539e-01,  2.96007896e-02,
        7.46764641e-02,  1.94998903e-02,  2.02895372e-03],
       [ 7.36429272e-02,  3.28728051e-02,  1.36268830e-01,
        2.40395757e-01,  1.42098226e-01,  1.70068634e-01,
        9.69070327e-02,  1.73277476e-02,  2.86656565e-02,
        4.83465550e-02,  1.33166949e-02,  8.91345040e-05],
       [ 1.51136214e-01,  2.43819782e-01,  1.12123998e-01,
        1.95376330e-01,  7.33482201e-02,  2.07539735e-02,
        9.13700250e-02,  2.62708525e-04,  2.50361224e-02,
        6.75423617e-02,  1.86785761e-02,  5.51687902e-04],
       [ 8.36638655e-02,  3.57983193e-02,  1.89243697e-02,
```

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6.22689076e-01, 9.06890756e-02, 7.66050420e-02,
3.61344538e-02, 1.22352941e-02, 1.12605042e-02,
6.82352941e-03, 5.10924370e-03, 6.72268908e-05],
[ 1.75517094e-02, 8.88771380e-03, 9.51819236e-03,
7.06481726e-01, 5.55838028e-02, 1.03581525e-01,
5.40381134e-02, 1.14299660e-02, 2.37548049e-02,
8.19622120e-03, 9.76224857e-04, 0.00000000e+00],
[ 1.31997563e-02, 3.82319096e-01, 5.95004400e-02,
4.57591552e-02, 1.31794490e-01, 2.72524200e-01,
2.05103906e-02, 3.85162120e-02, 5.27990252e-03,
8.52907331e-03, 2.18642117e-02, 2.03073174e-04],
[ 5.12070227e-03, 5.48646672e-02, 2.92611558e-03,
5.26700805e-02, 5.34016094e-02, 2.73591807e-01,
6.58376006e-03, 2.26773958e-02, 7.31528895e-03,
6.58376006e-03, 7.31528895e-04, 5.13533285e-01]]))

```

Start Matrix:

```

array([ 0.21339972, 0.14129979, 0.03434661, 0.04509085, 0.12283368,
0.08901118, 0.0911775 , 0.04916143, 0.03665269, 0.15971349,
0.01678896, 0.00052411])

```

Emission Matrix:

```

array([[ 5.10846669e-01, 0.00000000e+00, 0.00000000e+00, ...,
0.00000000e+00, 0.00000000e+00, 0.00000000e+00],
[ 0.00000000e+00, 6.18013269e-05, 5.59847314e-04, ...,
3.63537217e-06, 0.00000000e+00, 3.63537217e-06],
[ 0.00000000e+00, 0.00000000e+00, 0.00000000e+00, ...,
0.00000000e+00, 1.19644417e-05, 0.00000000e+00],
...,
[ 0.00000000e+00, 0.00000000e+00, 0.00000000e+00, ...,
0.00000000e+00, 0.00000000e+00, 0.00000000e+00],
[ 0.00000000e+00, 0.00000000e+00, 0.00000000e+00, ...,
0.00000000e+00, 0.00000000e+00, 0.00000000e+00],
[ 2.19138057e-03, 0.00000000e+00, 0.00000000e+00, ...,
0.00000000e+00, 0.00000000e+00, 0.00000000e+00]])

```

Viterbi Algorithm:

For the following corpus:

The Fulton County Grand Jury said Friday an investigation of Atlanta's recent primary election produced `` no evidence " that any irregularities took place .

DET NOUN NOUN ADJ NOUN VERB NOUN DET NOUN ADP NOUN ADJ NOUN NOUN VERB . DET NOUN . ADP
DET NOUN VERB NOUN . -True

DET NOUN ADP DET NOUN ADP DET NOUN ADP DET NOUN ADP DET NOUN ADP DET NOUN ADP DET
NOUN ADP DET NOUN ADP DET -predicted

Testing on last 10 sentences of brown Corpus:

Achieved an accuracy of 0.923871132215036

Task 3:

By using same data of Viterbi algorithm for CRF, we achieved an f1-score of 0.12985271687027178

Classification Report:

| | precision | recall | f1-score | support |
|-------------|-----------|--------|----------|---------|
| . | 0.800 | 0.242 | 0.372 | 33 |
| X | 0.023 | 1.000 | 0.044 | 3 |
| ADJ | 0.000 | 0.000 | 0.000 | 18 |
| ADP | 0.179 | 0.185 | 0.182 | 27 |
| ADV | 0.000 | 0.000 | 0.000 | 9 |
| VERB | 0.000 | 0.000 | 0.000 | 35 |
| DET | 0.121 | 0.121 | 0.121 | 33 |
| CONJ | 0.000 | 0.000 | 0.000 | 7 |
| NOUN | 0.242 | 0.157 | 0.190 | 51 |
| PRON | 0.000 | 0.000 | 0.000 | 12 |
| PRT | 0.000 | 0.000 | 0.000 | 11 |
| NUM | 0.000 | 0.000 | 0.000 | 0 |
| avg / total | 0.199 | 0.117 | 0.130 | 239 |