Hw5

- Q1 (5 pts): run Mallet

- Q2 (25 pts): MaxEnt decoder

- Q3 (15 pts): calculate empirical expectation

- Q4 (30 pts): calculate model expectations

- standard portion: 25 points

Total: 100 pts

Q1: run Mallet MaxEnt learner

- The format of the model file:

FEATURES FOR CLASS c1

<default> 0.3243

t1 0.245

t2 0.491

....

FEATURES FOR CLASS c2

<default> 0.3243

t1 -30.412

t2 1.349

....

Q2: write a MaxEnt decoder

The formula for P(y | x):

$$p(y|x) = \frac{e^{\lambda_0(y) + \sum_{k=1}^{K} \lambda_k f_k(x,y)}}{Z}$$

$\lambda_0(y)$ is the weight of the default feature for y.

The k in f_k corresponds to a (class, feature) pair (c_i, t_j)

$f_k(x,y) = 1$ iff t_j is present in x and $y = c_i$.

Q2: calculate P(y|x)

- The format of the model file:

FEATURES FOR CLASS c1

<default> 0.324

t1 0.245

t2 0.491

t3 -0.22

FEATURES FOR CLASS c2

<default> 0.456

t1 -30.4

t2 1.349

t3 2.42

Suppose x is "t1 t3"

$$p(c_1|x) = \frac{e^{\lambda_0(c_1) + \sum_{k=1}^{K} \lambda_k f_k(x, c_1)}}{Z}$$

$$p(c_1|x) = \frac{e^{0.324 + 0.245 - 0.22}}{Z}$$

$$p(c_2|x) = \frac{e^{\lambda_0(c_2) + \sum_{k=1}^{K} \lambda_k f_k(x, c_2)}}{Z}$$

$$p(c_2|x) = \frac{e^{0.456 - 30.4 + 2.42}}{Z}$$

. . .

$$P(c1 \mid x) = \frac{A}{Z}$$

$$P(c2 \mid x) = \frac{B}{Z}$$

$$P(c3 \mid x) = \frac{C}{Z}$$

$$Z = A+B+C$$

$$P(c1 \mid x) = \frac{A}{A+B+C}$$

$$P(c2 \mid x) = \frac{B}{A+B+C}$$

$$P(c3 \mid x) = \frac{C}{A+B+C}$$

Q3-Q4: calculate expectation

$$E_{\widetilde{p}} f_j = \sum_{(x,y) \in X \times Y} \widetilde{p}(x,y) f_j(x,y)$$

$$E_p f_j = \sum_{(x,y) \in X \times Y} p(x,y) f_j(x,y)$$