$$M := 100$$
$$C := 20000$$
$$X_{i,t} \in N,\ i = 1...n,\ t = 1...L_i$$
$$Y_i \in N,\ i = 1...n$$
$$E \in R^{C,M}$$
$$Wz,\ Rz,\ Wi,\ Ri,\ Wf,\ Rf,\ Wo,\ Ro \in R^{M,M}$$
$$bz,\ pi,\ bi,\ pf,\ bf,\ po,\ bo \in R^{1,M}$$
$$x_{i,t} = E_{X_{i,t}},\ i = 1...n,\ t = 1...L_i$$
$$z_{i,1} = Tanh(x_{i,1} \cdot Wz + bz),\ i = 1...n$$
$$ig_{i,1} = Sigmoid(x_{i,1} \cdot Wi + bi),\ i = 1...n$$
$$fg_{i,1} = Sigmoid(x_{i,1} \cdot Wf + bf),\ i = 1...n$$
$$c_{i,1} = ig_{i,1} * z_{i,1},\ i = 1...n$$
$$o_{i,1} = Sigmoid(x_{i,1} \cdot Wo + c_{i,1} * po + bo),\ i = 1...n$$
$$y_{i,t} = o_{i,t} * Tanh(c_{i,t}),\ i = 1...n,\ t = 1...L_i$$
$$z_{i,t} = Tanh(x_{i,t} \cdot Wz + y_{i,t-1} \cdot Rz + bz),\ i = 1...n,\ t = 2...L_i$$
$$ig_{i,t} = Sigmoid(x_{i,t} \cdot Wi + y_{i,t-1} \cdot Ri),\ i = 1...n,\ t = 2...L_i$$
$$fg_{i,t} = Sigmoid(x_{i,t} \cdot Wf + y_{i,t-1} \cdot Rf),\ i = 1...n,\ t = 2...L_i$$
$$c_{i,t} = ig_{i,t} * z_{i,t} + fg_{i,t} * c_{i,t-1},\ i = 1...n,\ t = 2...L_i$$
$$o_{i,t} = Sigmoid(x_{i,t} \cdot Wo + y_{i,t-1} \cdot Ro + c_{i,t} * po + bo),\ i = 1...n,\ t = 2...L_i$$
$$r_i = \sum_{t=1}^{L_i} y_{i,t},\ i = 1...n$$
$$U \in R^{M,2}$$
$$b \in R^{1,2}$$
$$P_i = r_i \cdot U + b,\ i = 1...n$$
$$loss = \sum_{i=1}^{n} CrossEntropy(P_i,\ OneHot(Y_i,\ 2))$$
$$X,\ Y \sim \text{"}imdb.data\text{"}$$
$$E,\ Wz,\ Rz,\ Wi,\ Ri,\ Wf,\ Rf,\ Wo,\ Ro,\ pi,\ pf,\ po,\ U \sim Gaussian(0,\ 0.1)$$
$$bz,\ bi,\ bf,\ bo,\ b \sim Zero()$$
$$\min_{E,Wz,Rz,Wi,Ri,Wf,Rf,Wo,Ro,bz,pi,bi,pf,bf,po,bo,U,b} loss$$