3.3.3 Pseudocod

Algoritmul 5 Baum-Welch

intrări: $O \leftarrow$ secvența de observații, $\epsilon \leftarrow$ prag de convergență

{*Initializare*}

init. uniformă Π ($\Pi_i = 1/N, 1 \leq i \leq N$)

init. aleatoare $a_{i,j}$, a. î. $\sum_{j=1}^{N} a_{i,j} = 1, \quad 1 \leq j \leq N$

init. uniformă $b_{j,k}$ ($b_{j,k} = 1/M, \quad 1 \leq j \leq N, 1 \leq k \leq M$)

$oldP \leftarrow 0$

{*E STEP - în afara buclei*}

for $l = 1$ to L **do**

    $[logP_l, \hat{\alpha}_l, \hat{\beta}_l, Scale_l] = forward\_backward(O_l, \Pi, A, B)$

end for

$$logP \leftarrow \sum_{l=1}^{L} logP(l)$$

while $|logP - oldP| < \epsilon$ **do**

    $oldP \leftarrow logP$

    {M STEP - recalculeaza Π, A și B}

    $\Pi = update\_pi\_procedure(\hat{\alpha}, \hat{\beta}, Scale)$

    $A = update\_A\_procedure(O, \hat{\alpha}, \hat{\beta}, Scale)$

    $B = update\_B\_procedure(O, \hat{\alpha}, \hat{\beta}, Scale)$

    {*E STEP - calculeaza variantele scalate pentru α și β și probabilitatea curentă (log likelihood - $log(P(O|\bar{\lambda}))$) a secvenței observate*}

    for $l = 1$ to L **do**

        $[logP_l, \hat{\alpha}_l, \hat{\beta}_l, Scale_l] = forward\_backward(O_l, \Pi, A, B)$

    end for

    $$logP \leftarrow \sum_{l=1}^{L} logP(l)$$

end while

Algoritmul 6 Baum-Welch

Function update_pi_procedure($\hat{\alpha}$, $\hat{\beta}$, $Scale$)
for $i = 1$ to N **do**

$$\Pi_i = \frac{\sum_{l=1}^{L} \hat{\alpha}_{l,1,i} \cdot \hat{\beta}_{l,1}(i)/Scale_1}{\sum_{l=1}^{L}\sum_{j=1}^{N} \hat{\alpha}_{l,1}(j) \cdot \hat{\beta}_{l,1}(j)/Scale_1}$$

end for
return Π
EndFunction

Function update_A_procedure(O, $\hat{\alpha}$, $\hat{\beta}$, $Scale$)
for $i = 1$ to N **do**
    for $j = 1$ to N **do**

$$a_{i,j} = \frac{\sum_{l=1}^{L}\sum_{t=1}^{T_l-1} \hat{\alpha}_{l,t,i} \cdot a_{ij} \cdot b_{l,j}(o_{l,t+1}) \cdot \hat{\beta}_{l,t+1,j}}{\sum_{l=1}^{L}\sum_{t=1}^{T_l-1}\sum_{j=1}^{N} \hat{\alpha}_{l,t,i} \cdot a_{i,j} \cdot b_{l,j}(o_{l,t+1}) \cdot \hat{\beta}_{l,t+1,j}}$$

    end for
end for
return a
EndFunction

Function update_B_procedure(O, $\hat{\alpha}$, $\hat{\beta}$, $Scale$)
for $j = 1$ to N **do**
    for $k = 1$ to M **do**

$$b_{j,k} = \frac{\sum_{l=1}^{L}\sum_{t=1,O(t)=v_k}^{T(l)} \hat{\alpha}_{l,t,j} \cdot \hat{\beta}_{l,t,j}/Scale_{l,t}}{\sum_{l=1}^{L}\sum_{t=1}^{T(l)} \hat{\alpha}_{l,t,j} \cdot \hat{\beta}_{l,t,j}/Scale_{l,t}}$$

    end for
end for
return b
EndFunction