Data: Q, α, P_t, P_e, S
Output: ϕ'
for $k \leftarrow 0$ **up to** $|S| - 1$ **do**
  for $i \leftarrow 0$ **up to** $|Q| - 1$ **do**
    $V[i][k] \leftarrow -\infty$;
    $T[i][k] \leftarrow NIL$;
  end
end
for $i \leftarrow 1$ **up to** $|Q| - 1$ **do**
  $V[i][0] \leftarrow \log(P_t(q_i|q_0)) + \log(P_e(S[0]|q_i))$;
  if $V[i][0] > -\infty$ **then**
    $T[i][0] \leftarrow 0$;
  end
end
for $k \leftarrow 1$ **up to** $|S| - 1$ **do**
  for $i \in \lambda_{emit}[S[k]]$ **do**
    for $j \in \lambda_{trans}[q_i]$ **do**
      $v \leftarrow V[j][k-1] + \log(P_t(q_i|q_j)) + log(P_e(S[k]|q_i))$;
      if $v > V[i][k]$ **then**
        $V[i][k] \leftarrow v$;
        $T[i][k] \leftarrow j$;
      end
    end
  end
end
$y \leftarrow 1$;
push $\phi, 0$;
for $i \leftarrow 2$ **up to** $|Q| - 1$ **do**
  if $V[i][|S| - 1] + log(P_t(q_0|q_i)) > V[y][|S| - 1] + log(P_t(q_0|q_y))$ **then**
    $y \leftarrow i$;
  end
end
for $k \leftarrow |S| - 1$ **down to** 0 **do**
  push ϕ, y;
  $y \leftarrow T[y][k]$;
end
push $\phi, 0$;
return ϕ

Algorithm 1: The Viterbi algorithm