



Figure 1: The most likely sequence of hidden states vs. time

Results

1. (i) The decoded sentence is

'thensaiswatchingyou' → 'the nsa is watching you'

Listing 1: The MATLAB code for HMM speech recognizer

```

1  %{
2  Author: Mehmet Koc
3  Description: HMM Speech Recognition
4  %}
5  close all
6  clear
7  %read data
8  Ot = importdata('observations.txt') + 1;
9  A = importdata('transitionMatrix.txt');
10 B = importdata('emissionMatrix.txt');
11 pi = importdata('initialStateDistribution.txt');
12 %%
13 T = length(Ot);
14 n = length(pi);
15 %compute max log-likelihood for all t=1:T
16 %also save the most probable state transitions
17 L = zeros(n, T);
18 phi = zeros(n, T);
19 l1 = log(pi) + log(B(:, Ot(1)));

```

```

20 L(:, 1) = l1;
21 for i = 2:T
22     lMat = repmat(L(:, i-1), [1, n]);
23     [maxL, ind] = max(lMat + log(A));
24     L(:, i) = maxL' + log(B(:, Ot(i)));
25     phi(:, i) = ind';
26 end
27 %%
28 %best state sequence
29 S = zeros(T, 1);
30 [~, S(T)] = max(L(:, T));
31 %backtracking
32 for i = (T-1):-1:1
33     S(i) = phi(S(i+1), i+1);
34 end
35 isRepeated = false(T, 1);
36 for i = 2:T
37     if(S(i) == S(i-1))
38         isRepeated(i) = 1;
39     end
40 end
41 %decode and eliminate repetitions
42 sentence = S(~isRepeated);
43 alphabet = char(97:122);
44 sentenceDecoded = alphabet(sentence);
45 %%
46 %plot the most likely sequence of hidden states vs time
47 figure, plot(S, 'linewidth', 2);
48 xlim([1, T]); ylim([0, n+1]);
49 xlabel('Time (t=1:T)'); ylabel('Hidden state value (1 to 26)');
50 title('The most likely sequence of hidden states vs. time');

```