Lecture Speechprocessing

Excercise 5

1. Dynamic Time Warping (DTW)

Berechnen Sie zu den Beobachtungen X die wahrscheinlichste Musterzuordnung Y mit dem DTW-Algorithmus. Die lokalen Distanzen sind in den folgenden Tabellen dargestellt:
Y_1:

	x_1	x_2	x_3	x_4
y_1	1	4	5	8
y_2	4	3	2	7
y_3	7	4	9	1

Y_2:

	x_1	x_2	x_3	x_4
y_1	2	1	4	5
y_2	1	0	6	0
y_3	9	3	6	2

Dekodierung

1. The output of an ASR systen can be a lattice. Calculate using the Viterbi algorithm the most possible path through the lattice, given in the appendix.

start node	end node	Sum of the propabilities from acoustic model and language model and the accumulated predecessors		
0	1	-1432,27-0	=	-1432,27
0	2	-1500,93-0	=	-1500,93
0	3	-3759,32-0	=	-3759,32
0	4	-3829,60-0	=	-3829,60
1	5	(-2434,05-87,29)-1432,27	=	-3953,61
2	5	(-2431,55-87,29)-1500,93	=	

2. Phonology
   (a) What is a phonem
   (b) What is the difference between monophone and tryphone?
   (c) How many triphones are theoretically possible? Why are not all of them used?

3. Repetition

   - Scetch the components of an ASR-System, explain them
   - Explain the Bayes formula.
   - What is a Cepstrum?
   - What is a Bigramm?
   - Explain the Viterbi Algorithm and what are its pros?
   - What is a HMM? What is meant by the term production model?
   - What is a pnhoneme lexicon?
   - Where do we use the LDA?
   - Explain the Baum-Welch algorithm.
   - What is tying?
   - Explain the tube model
   - What is a feature vector? What is the difference between static and dynamic features?
   - What is dynamic time warping?

Appendix

Lattice woth N=24 L=39

Node definitions:

I=0	t=0.00	I=6	t=0.71	I=12	t=0.72	I=18	t=0.81
I=1	t=0.25	I=7	t=0.72	I=13	t=0.73	I=19	t=0.81
I=2	t=0.26	I=8	t=0.72	I=14	t=0.78	I=20	t=1.33
I=3	t=0.61	I=9	t=0.72	I=15	t=0.78	I=21	t=2.09
I=4	t=0.62	I=10	t=0.72	I=16	t=0.80	I=22	t=2.09
I=5	t=0.62	I=11	t=0.72	I=17	t=0.80	I=23	t=2.85

Link definitions:

J=0	S=0	E=1	W=!ENTER	v=0	a=-1432.27	l=0.00
J=1	S=0	E=2	W=!ENTER	v=0	a=-1500.93	l=0.00
J=2	S=0	E=3	W=!ENTER	v=0	a=-3759.32	l=0.00
J=3	S=0	E=4	W=!ENTER	v=0	a=-3829.60	l=0.00
J=4	S=1	E=5	W=TO	v=3	a=-2434.05	l=-87.29
J=5	S=2	E=5	W=TO	v=1	a=-2431.55	l=-87.29
J=6	S=4	E=6	W=AND	v=3	a=-798.30	l=-69.71
J=7	S=4	E=7	W=IT	v=0	a=-791.79	l=-62.05
J=8	S=4	E=8	W=AND	v=2	a=-836.88	l=-69.71
J=9	S=3	E=9	W=BUT	v=0	a=-965.47	l=-51.14
J=10	S=4	E=10	W=A.	v=0	a=-783.36	l=-105.95
J=11	S=4	E=11	W=IN	v=0	a=-835.98	l=-49.01
J=12	S=4	E=12	W=A	v=0	a=-783.36	l=-59.66
J=13	S=4	E=13	W=AT	v=0	a=-923.59	l=-77.95
J=14	S=4	E=14	W=THE	v=0	a=-1326.40	l=-27.96
J=15	S=4	E=15	W=E.	v=0	a=-1321.67	l=-121.96
J=16	S=4	E=16	W=A	v=2	a=-1451.38	l=-59.66
J=17	S=4	E=17	W=THE	v=2	a=-1490.78	l=-27.96
J=18	S=4	E=18	W=IT	v=0	a=-1450.07	l=-62.05
J=19	S=5	E=18	W=IT	v=0	a=-1450.07	l=-110.42
J=20	S=6	E=18	W=IT	v=0	a=-775.76	l=-85.12
J=21	S=7	E=18	W=IT	v=0	a=-687.68	l=-125.32
J=22	S=8	E=18	W=IT	v=0	a=-687.68	l=-85.12
J=23	S=9	E=18	W=IT	v=0	a=-687.68	l=-50.28
J=24	S=10	E=18	W=IT	v=0	a=-689.67	l=-108.91
J=25	S=11	E=18	W=IT	v=0	a=-706.89	l=-113.78
J=26	S=12	E=18	W=IT	v=0	a=-689.67	l=-194.91
J=27	S=13	E=18	W=IT	v=0	a=-619.20	l=-100.24
J=28	S=4	E=19	W=IT	v=1	a=-1567.49	l=-62.05
J=29	S=14	E=20	W=DIDN'T	v=0	a=-4452.87	l=-195.48
J=30	S=15	E=20	W=DIDN'T	v=0	a=-4452.87	l=-118.62
J=31	S=16	E=20	W=DIDN'T	v=0	a=-4303.97	l=-189.88
J=32	S=17	E=20	W=DIDN'T	v=0	a=-4303.97	l=-195.48
J=33	S=18	E=20	W=DIDN'T	v=0	a=-4222.70	l=-78.74
J=34	S=19	E=20	W=DIDN'T	v=0	a=-4235.65	l=-78.74
J=35	S=20	E=21	W=ELABORATE	v=2	a=-5847.54	l=-62.72
J=36	S=20	E=22	W=ELABORATE	v=0	a=-5859.59	l=-62.72
J=37	S=21	E=23	W=!EXIT	v=0	a=-4651.00	l=-13.83
J=38	S=22	E=23	W=!EXIT	v=0	a=-4651.00	l=-13.83