KTH ROYAL INSTITUTE
OF TECHNOLOGY

DT2119 Speech and Speaker Recognition Lab 2

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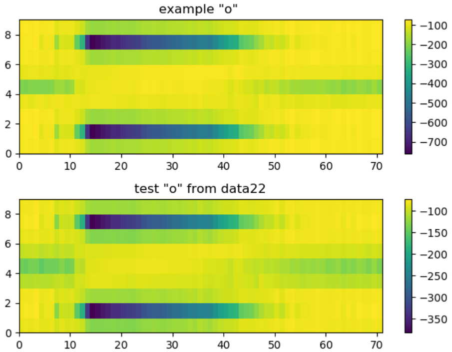
May 2, 2019

5.1 Gaussian emission probabilities



- isolated['o'] = ['sil'] + prondict['o'] + ['sil']

5.2 Forward Algorithm

- Maximum likelihood accuracy
  trained on all speakers: 43/44
  trained on one speaker: 34/44

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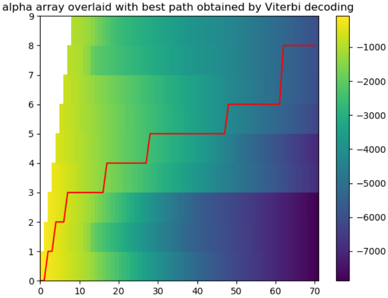
Accuracy(trained on all speakers): 43
['o', 'o', 'z', 'z', '1', '1', '2', '2', '3', '3', '4', '4', '5', '5', '6', '6', '7', '7', '8', '8', '9', '9',
'o', 'o', 'z', 'z', '1', '1', '2', '2', '3', '3', '4', '4', '5', '5', '6', '6', '7', '7', '8', '8', '1', '9']
Accuracy(trained on one speaker):34
['o', 'o', 'z', 'z', '3', '9', '3', '2', '3', '3', '4', '4', '3', '3', '6', '6', '3', '3', '3', '3', '9', 'z',
'o', 'o', 'z', 'z', '1', '1', '2', '2', '3', '3', '4', '4', '5', '5', '6', '6', '7', '7', '8', '8', '9', '9']
```

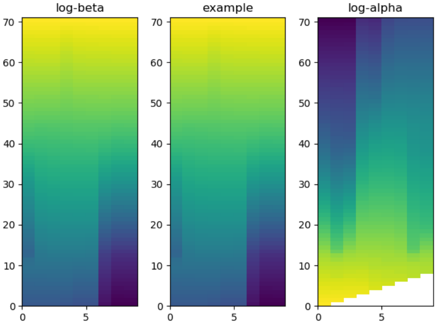
- Viterbi algorithm accuracy
  trained on all speakers: 44/44
  trained on one speaker: 34/44 (same mistakes as ML)
- Computational complexity
  Viterbi scoring: $\mathcal{O}(n^2 T)$
  Forward scoring: $\mathcal{O}(n^2 T)$

5.3 Viterbi Approximation



- $\alpha_n(j) = P(x_0, ..., x_n, z_n = s_j \mid \theta)$
- $logV_n(j) = max_{i=0}^{M-1}(logV_{n-1}(i) + loga_{ij}) + log\phi_j(x_n)$
- $B_n(j) = argmax_{i=0}^{M-1}(logV_{n-1}(i) + loga_{ij})$

5.4 Backward Algorithm

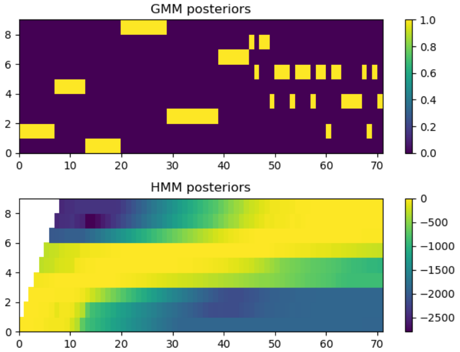


- $\beta_n(i) = P(x_{n+1}, \ldots, x_{N-1} \mid z_n = s_i, \theta)$

6.1 State posterior(Gamma) probabilities

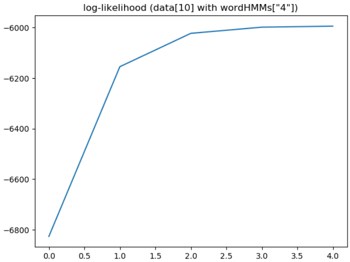
- HMM posteriors: $\gamma_n(i) = P(z_n = s_i \mid X, \theta)$
  Summing along state: 1 (in linear domain)
  Summing along the time axis: expectation visiting time for each state
  Summing over both states and time steps = length of the observation(71)

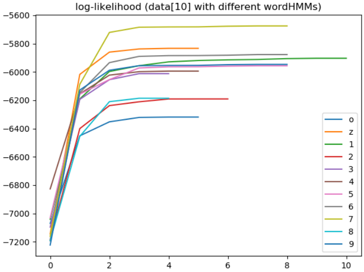
6.1 State posterior(Gamma) probabilities



- HMM posteriors: $\gamma_n(i) = P(z_n = s_i \mid X, \theta)$
- GMM posteriors: $\gamma_n^{GMM}(i) = P(z_n = s_i \mid x_n, \phi)$

6.2 Retraining the emission probabilities distributions





Threshold = 0.1

Thank you for your Attention!