

Course 12	<b>Hidden Markov Models</b>
Program	<ol style="list-style-type: none"> <li>1. Introduction <ol style="list-style-type: none"> <li>1.1. Introduction to Hidden Markov Models</li> <li>1.2. Hidden Markov Models definition</li> <li>1.3. Application of HMMs to speech recognition</li> <li>1.4. Overview of quantification</li> </ol> </li> <li>2. Discrete Hidden Markov Models <ol style="list-style-type: none"> <li>2.1. Presentation of Discrete HMMs: model description</li> <li>2.2. HMM simple examples</li> </ol> </li> <li>3. Basic algorithms for Hidden Markov Models. <ol style="list-style-type: none"> <li>3.1. Forward-backward</li> <li>3.2. Viterbi decoding</li> <li>3.3. Baum-Welch reestimation</li> <li>3.4. Practical issues for the implementation</li> </ol> </li> <li>4. Semicontinuous Hidden Markov Models <ol style="list-style-type: none"> <li>4.1. Overview, advantages and disadvantages</li> <li>4.2. Formulae modification in the basic algorithms</li> </ol> </li> <li>5. Continuous Hidden Markov Models. <ol style="list-style-type: none"> <li>5.1. Overview, advantages and disadvantages</li> <li>5.2. Formulae modification in the basic algorithms</li> <li>5.3. Multi-Gaussian modeling</li> </ol> </li> <li>6. Unit selection and clustering <ol style="list-style-type: none"> <li>6.1. Considerations for unit selection in Hidden Markov Models</li> <li>6.2. Parameter sharing</li> <li>6.3. Unit clustering in HMMs</li> </ol> </li> <li>7. Speaker and Environment Adaptation for HMMs <ol style="list-style-type: none"> <li>7.1. Adaptation modes</li> <li>7.2. Maximum Likelihood Linear Regression (MLLR)</li> <li>7.3. Maximum a Posteriori (MAP)</li> <li>7.4. Rapid adaptation</li> </ol> </li> <li>8. Other applications of HMMs <ol style="list-style-type: none"> <li>8.1. HMMs for alignment and gene finding in DNA</li> <li>8.2. HMMs for handwritten word recognition</li> <li>8.3. HMMs for lip reading</li> <li>8.4. HMMs for stroke recognition in tennis videos</li> <li>8.5. HMMs for electricity market modelling</li> </ol> </li> </ol> <p>Practical demonstration: An open-source solution for HMM modeling: The HTK toolkit from Cambridge University.</p>
Bibliography	<p><i>Hidden Markov Models for Speech Recognition</i>. X.D.Huang, J. Ariki, M. A. Jack. Edinburgh University Press, 1990.</p> <p><i>Spoken Language Processing</i>. Huang, X., Acero, A., Hon, H.W. Ed. Prentice Hall, New Jersey, 2001.</p>
Prerequisites	The attendant should be familiar with some basics in pattern recognition, multivariate Gaussian distribution, dynamic programming
Readings before attending	<p>Attendant will benefit more from the course if they read before coming:</p> <ul style="list-style-type: none"> <li>• Rabiner, Lawrence R. "<a href="#">A Tutorial on Hidden Markov Models and Selected Applications in Speech Recognition</a>". Proceedings of the IEEE , Vol. 77, No. 2, February 1989, pp. 257-286</li> <li>• <a href="#">A tutorial on HMMs</a>.</li> <li>• <a href="#">The HTK reference manual</a>.</li> </ul>