

# Curriculum Vitae

# Kyogu Lee

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## EDUCATION

- 2002-2008      Ph.D. in Computer-Based Music Theory and Acoustics  
Center for Computer Research in Music and Acoustics (CCRMA)  
Stanford University, CA, USA
- 2005-2007      M.S. in Electrical Engineering  
Stanford University, CA, USA
- 2000-2002      M.M. in Music Technology  
New York University, NY, USA
- 1992-1996      Electrical Engineering  
Seoul National University, Seoul, Korea

## DISSERTATION

### *A System for Acoustic Chord Transcription and Key Extraction from Audio Using Hidden Markov models Trained on Synthesized Audio*

This dissertation discusses a statistical model for automatically identifying musical chords from the raw audio, and demonstrates several potential applications such as music segmentation, music summarization, and music similarity finding. In order to avoid the enormously time-consuming and laborious process of manual annotation, which must be done to provide the ground-truth to the supervised learning models, symbolic data like MIDI files are used to obtain a large amount of labeled training data. The experimental results show that the proposed system not only yields the chord recognition performance comparable to or better than other previously published systems, but also provides additional information of key and/or genre without using any other algorithms or feature sets for such tasks. It is also demonstrated that the chord sequence with precise timing can be successfully used to find cover songs from audio and to detect musical phrase boundaries by recognizing the cadences or harmonic closures.

Advisor: Julius Smith

Reading Committee: Jonathan Berger, Chris Chafe, Malcolm Slaney

## **ACADEMIC AWARDS**

- 2006            2<sup>nd</sup> place in the MIREX task on Audio Cover Song Identification
- 2005-2006     Dorothy Culver Haynie Fellowship, Stanford University
- 2002-2003     Department Fellowship, Stanford University
- 1994            2<sup>nd</sup> place in the first International Robot Contest, Japan

## **MEMBERSHIPS**

- 2006-present   Institute of Electrical and Electronics Engineers (IEEE), Member
- 2008-present   Association of Computing Machinery (ACM), Member
- 2006-2007      Acoustical Society of America (ASA), Student Member
- 2005-2007      International Computer Music Association (ICMA), Student Member

## **REVIEW ACTIVITIES**

- 2007-present   IEEE Transactions on Speech, Audio, and Language Processing
- 2007-present   Computer Music Journal
- 2007-present   International Symposium on Music Information Retrieval

## **TEACHING/RESEARCH INTERESTS**

- Music/Multimedia and Semantic Web
- Music/Multimedia Information Retrieval
- Multimedia Content Analysis
- Machine Learning Methods for Multimedia Applications
- Computational Model of Music Perception/Cognition
- Complex Data Sonification
- Digital Audio Signal Processing

## TEACHING EXPERIENCE

- Summer 2007 Instructor, CCRMA Summer Workshop in Korea, Yonsei University, Seoul, Korea  
Course: Music Information Retrieval
- designed core curriculum (lectures and labs)
  - delivered lectures and led lab sessions
- 2003-2005 Teaching Assistant, Music/Electrical Engineering, Stanford University, CA, USA
- developed weekly problem sets
  - evaluated course performance
  - held regular office hours
  - conducted student advising/counseling.
- Spring 2005 Music/Audio Applications of the FFT
- Winter 2005 Perceptual Audio Coding
- Fall 2004 Auditory Remapping of Bioinformatics
- Spring 2004 Elements of Music Theory
- Winter 2004 Compositional Algorithms, Psychoacoustics, and Spatial Processing
- Fall 2003 Introduction to Digital Signal Processing

## PROFESSIONAL EXPERIENCE

- 2007-present Multimedia Researcher, Gracenote Inc., Emeryville, CA, USA  
Research and development in multimedia content analysis for efficient and effective search/retrieval
- 2005-2007 Research Assistant, Stanford University, CA, USA  
Research topic: audio content analysis, music information retrieval.
- Summer 2006 Research Engineer, Gracenote Inc., Emeryville, CA, USA  
Designed algorithms to compute musical complexity from the raw audio.
- Summer 2006 Research Engineer, Sennheiser Palo Alto Research Center, Palo Alto, CA, USA  
Designed algorithms and built a prototype for virtual surround with multi-driver technologies.
- 2003-2004 Research Assistant, Stanford University (funded by DARPA), CA, USA  
Member of a team who designed algorithms for Sonification of Complex Data. Designed various mapping schemes using vocal synthesis models to sonify hyperspectral colon tissue images.
- 2001-2002 Software Engineer, Soundball Inc., NY, USA  
Designed TestSuite and Opcode Library for SAOL Compiler/Player.

## PROFESSIONAL EXPERIENCE CONTINUED

1996-1999      Software/Hardware Engineer, MIRAE Corporation, Chonan, Korea  
Developed hardware/software for motion controller and I/O controller. Conducted equipments maintenance.

## PUBLICATIONS

- Lee, K. (2008). "A System for Acoustic Chord Transcription and Key Extraction from Audio Using Hidden Markov Models Trained on Synthesized Audio", Ph.D. thesis, Stanford University
- Lee, K., & Slaney, M. (2008). "Acoustic Chord Transcription and Key Extraction from Audio Using Key-Dependent HMMs Trained on Synthesized Audio", *The IEEE Transactions on Audio, Speech and Language Processing*, 16(2), pp. 291-301
- Lee, K. & Slaney, M. (2007). "A Unified System for Chord Transcription and Key Extraction from Audio Using Hidden Markov Models", in *Proceedings of International Conference on Music Information Retrieval*
- Lee, K. (2007). "A System for Automatic Chord Transcription Using Genre-Specific HMMs", in *Proceedings of International Workshop on Adaptive Multimedia Retrieval*
- Lee, K., & Slaney, M. (2006). "Automatic Chord Recognition from Audio Using a Supervised HMM Trained with Audio-from-Symbolic Data", in *Proceedings of Audio and Music Computing for Multimedia Workshop in conjunction with ACM Multimedia*
- Lee, K., & Slaney, M. (2006). "Automatic Chord Recognition Using an HMM with Supervised Learning", in *Proceedings of International Symposium in Music Information Retrieval*
- Lee, K., (2006). "Automatic Chord Recognition Using Enhanced Pitch Class Profile", in *Proceedings of International Computer Music Conference*
- Lee, K. & Kim, M. (2005). "Estimating the Amplitude of the Cubic Difference Tone Using a Third-Order Adaptive Volterra Filter", in *Proceedings of International Conference on Digital Audio Effects*
- Lee, K., Sell, G. & Berger, J. (2005). "Sonification Using Digital Waveguide And 2- and 3-Dimensional Digital Waveguide Mesh", in *Proceedings of International Conference on Auditory Display*
- Master, A. & Lee, K. (2005). "Explicit Onset Modeling Using Time Reassignment", in *Proceedings of IEEE International Conference on Acoustics, Speech, and Signal Processing*
- Lee, K. & Smith, J. (2004). "Implementation of a Highly Diffusing 2-D Digital Waveguide Mesh with a Quadratic Residue Diffuser", in *Proceedings of International Computer Music Conference*
- Cassidy, R., Berger, J. & Lee, K. (2004). "Analysis of hyperspectral colon tissue images using vocal synthesis models", in *IEEE Asilomar Conference On Signals, Systems, and Computers*
- Cassidy, R., Berger, J. & Lee, K. (2004). "Auditory Display of Hyperspectral Colon Tissue Images Using Vocal Synthesis Models", in *Proceedings of International Conference on Auditory Display*

## INVITED TALKS

- 2007      *Toward Content-based Music Information Retrieval: A System for Chord Transcription, Key Extraction, and its Applications*, Korea University, Seoul, Korea
- 2007      *Toward Content-based Music Information Retrieval: A System for Chord Transcription, Key Extraction, and its Applications*, AOL Labs, Mountain View, CA, USA
- 2007      *A System for Chord Transcription, Key Extraction, and Cadence Recognition Using Hidden Markov Models*, Chung-ang University, Seoul, Korea
- 2006      *Automatic Chord Recognition using Hidden Markov Models Trained on Audio-from-Symbolic data*, Korea Institute of Science and Technology, Daejeon, Korea
- 2006      *Music Similarity Finding Using Middle-Level Harmonic Content of Musical Audio*, Samsung Advanced Institute of Technology, Suwon, Korea
- 2005      *Application of Quadratic Residue Diffuser in a 2-Dimensional Digital Waveguide Mesh*, Chung-ang University, Seoul, Korea
- 2005      *Effective Vowel Classification Using Auditory Model-based Front End*, Korea Institute of Science and Technology, Daejeon, Korea

## REFERENCES

*Prof. Julius Smith*

Center for Computer Research in Music and Acoustics  
Department of Music and Electrical Engineering, Stanford University  
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