
Offered by

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SIP FYP Projects (pgs. 26-29)

- Spoken Language Systems / IDEAL House (4A)
- Speech Processing (4B, 4C, 4D)
- Intelligent Information Processing (4E, 4F)
- Biomedical Engineering (4G)
- Pattern Recognition (4H)
- Cryptography (4I, 4J)
4A. Voice-activated Speech and Speaker Recognition Interactive Systems

- Command and Control
- Speaker Authentication
- Others: voice activity detection, keyword spotting, continuous speech recognition, language understanding
- More than one student (on different sub-projects)
IDEAL House

• Voice-activated Assistance and Sound Monitoring
  – You are home, how many things you need to manipulate:
    • Remote controls (at least 2 or 3!)
    • Telephone dialling
    • Switch on/off appliances, lamps, etc.
  – **ANSWER**: Use the power of your voice!

  – You are still home, is it listening?
    • Fridge beeping (door left open), microwave beeping (food cooked), but you are not in the vicinity
  – **ANSWER**: Detect the sounds, classify, and react accordingly (house knows where you are and tells you: “food is cooked, come and get it!”)
4B. Reconstruction of Noise Corrupted Spectrogram

- Additive noise dominates some time-frequency regions and will adversely affect recognition (by machine and humans).
- Identify regions where noise dominates and attempt to “reconstruct” the damaged regions by removing the noise and using the known properties of speech and the reliable parts of the spectrogram.
- Listen to the reconstructed speech and perform recognition.
Speech Processing

- 4C. Single Channel Blind Source Separation
  - Two signals (speech + music), need to extract the speech signal, how?
  - Two microphones, easy: use beam-forming or BSS to spatially separate signals
  - Single channel recording, harder: but more interesting. Train basis functions on signal of interest and use to detect signal (signal-space analysis!)
• **4D. Performance Evaluation of Auditory Models**
  
  - Use the available MATLAB software (Auditory Image Modeling (AIM) and/or Development System for Auditory Modellings (DSAM))
  
  - Implement and evaluate different models for the identification of important perceptual cues that can be exploited by speech recognisers.
4E. Music Classification and Summarisation

- Use classification paradigms (neural networks, support vector machines (SVM), neuro-fuzzy networks (NFN), etc.) on different music genres (rock, jazz, classical)
- Use higher level semantic and knowledge based processed to segment and summarise music pieces.
4F. Nonlinear Function Mapping using Neural Networks (also fuzzy/evolutionary methods)

- VTR tracking: $f(12d \text{ features}) = 4 \text{ VTRs}$
- Generation model: $f(4 \text{ VTRs}) = 12d \text{ features}$
- We have the VTR data (just released) and the feature data, now we need the mapping!
- Universal Function Approximators: MLP, RBF, NFN, GA
- *Microsoft Research (USA) is interested in this work*
4G. Real time EEG processing for interactive ERP and TMS

- Apply a stimulus to produce an Evoked Response Potential (ERP)
- Stimulus timing is dependent upon the recognition of a transitory Brain Wave State in the Electroencephalogram (EEG)
- In this project we aim to apply signal processing and syntactic pattern recognition for automated identification and classification.

INTERESTED?

- Contact Roberto Togneri directly so a visit with Dr. Greg Price from CCRN (Centre for Clinical Research in Neuropsychiatry) can be arranged.
Pattern Recognition

- 4H. Etch Pit Density (EPD) of Semiconductor Wafers
  - Image processing to enhance defects (e.g. thresholding, mask processing, 2D FFT, etc.)
  - Detection of defects (feature extraction, clustering and classification)
  - Counting the number of defects
  - *Jointly Supervised with MRG*
4I. Performance Analysis of Cryptographic Algorithms

- Maths/CS/IT Majors:
  - evaluation of ECC based schemes (strength, computations, etc.)
  - analysis of timing attacks based on CPU, cache profiling

- Otherwise: Implement and evaluate publicly available private and public key encryption algorithms for computational and memory resource requirements, what do you recommend?
  - Supported by Motorola Research Australia
4J. Evaluation of Identity-Based Encryption Scheme

- With public-key encryption maintaining the most up-to-date public-keys of your recipients is an issue.
- With IBE all you need to do is know the email address of the recipient and encrypt the email using that as the key!
- Only the recipient needs to worry about authenticating himself/herself so to obtain the corresponding decryption key.
- Implement a prototype IBE based scheme, and equivalent PKI scheme and evaluate the strengths and weaknesses.
- **Supported by Motorola Research Australia**
Want to know more?

• SIP FYP 2007 Projects Page
  – Also lists 2006 projects (most are still available) and 2008 projects (which didn’t make it this year) in case you are interesting in more projects in this area, or
  – Suggest your own project in the speech, information and signals area!

• Contact me: [roberto@ee.uwa.edu.au](mailto:roberto@ee.uwa.edu.au)

• Interested students can get more information on each project including:
  – Reading list of the key articles and textbooks
  – Selected WWW pages and resources
  – Links to software and manuals
  – Contact emails of collaborators who are involved with the project