
By

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New multimedia signal processing algorithms

• Smartphone,
• Smart watch
• Kinect for Xbox
• Body sensors
• Brain-computer interface
• and etc.
Novel multimedia communication and stream systems

- 3D video streaming
- High Definition (HD) video streaming
- Mobile audio/video streaming
- Multimedia sensor networks

New paradigm of multimedia feature engineering

- Multimodal deep learning
- Deep learning-based video understanding
Large scale multimedia indexing algorithms

- MapReduce-based petabyte image/video indexing algorithms
- Locality-sensitive hashing for massive multimedia indexing

Scalable multimedia retrieval and mining algorithms

- Ultra-fast approximate nearest neighbor algorithm for massive image/video retrieval
- Online semantics-preserving algorithms for enhancing Bag-of-words (BoW) model
Distributed and parallel computing platform for massive multimedia process

- New computing system based on MapReduce and Key/value pair expansion
- New cluster computing system that can handle three types of tasks (MPI tasks, Hadoop tasks, Interactive Tasks)

Distributed machine learning algorithms for multimedia semantic learning

- Learning to rank boosted decision tree for large scale multimodal learning
- Applications of Apache Mahout machine learning library to scalable multimedia learning
- Berkeley MLBase to scalable multimedia learning
GPU-based multimedia architectures and systems

• GPU-based real-time video tracking system for high speed (5000 frames per second) cameras

Intriguing applications of multimedia computing

• Healthcare
• Biology
• Social network
• Gaming
• Virtual and augmented reality
• And etc.
Some potential topics for course projects

• X-Box and Kinect-based Motion Capturing, Uploading, and Storage
  • Main programming language and library
    • C++, C#, Microsoft Kinect SDK, Microsoft XNA, and Visual Studio
  • Main algorithms
    • Computational geometry
    • Networking
    • Image/Video Database
• Kinect-based Motion Indexing and Retrieval
  • Main programming language and library
    • C/C++
  • Main algorithms
    • Feature extraction
    • Motion indexing
    • Similarity matching
    • Content-based retrieval

• Smartphone-based Food Recognition
  • Main programming language and library
    • Java or Objective C
    • Platform: Android or iOS
  • Main algorithms
    • Signal processing
    • Feature Extraction
    • Feature Compression
    • Time Series Mining
    • Food image database
    • Nutrition database
• Smartphone-based Fall Detection
  • Main programming language and library
    • Java or Objective C
    • Platform: Android or iOS
  • Main algorithms
    • Signal processing
    • Feature Extraction
    • Time Series Mining

• Smartphone-based Walking Speed Measurement
  • Main programming language and library
    • Java or Objective C
    • Platform: Android or iOS
  • Main algorithms
    • Signal processing
    • Feature Extraction
    • Time Series Mining
• **Smart Vision for Home Environment**
  • Main programming language and library
    • Java, C/C++
    • OpenCV (http://opencv.org/, http://opencv.willowgarage.com/wiki/)
    • ImageJ (http://rsbweb.nih.gov/ij/)
  • Main algorithms
    • Image Processing
    • Pattern Recognition

• **Data Visualization for Decision Support**
  • Main programming language and library
    • Javascript
    • D3.js (http://d3js.org/)
    • WebGL, jQuery, JavaScript API
    • CSS
    • Blender (http://www.blender.org)
  • Main algorithms
    • Human computer interface algorithm
    • Visualization
    • Decision support system
• Large Scale Image Indexing and Search
  • Main programming language and library
    • Java
    • Matlab
    • R (http://www.r-project.org/)
    • ImageTerrier (http://www.imageterrier.org/)
    • OpenIMAJ (http://www.openimaj.org/)
  • Main algorithms
    • Image Processing
    • Feature Extraction
    • Indexing
    • Information Retrieval

• Scalable Multimedia Learning
  • Main programming language and library
    • Java
    • Matlab
    • MLbase: Scalable machine-learning (http://mlbase.org)
  • Main algorithms
    • Multimedia processing
    • Machine learning
    • Information Retrieval
• Ultra-fast approximate nearest neighbor search for image/video applications
  • Main programming language and library
    • Java/C++
    • ANN: A Library for Approximate Nearest Neighbor Searching (http://www.cs.umd.edu/~mount/ANN/)
    • FLANN - Fast Library for Approximate Nearest Neighbors (http://www.cs.ubc.ca/research/flann/)
  • Main algorithms
    • nearest neighbor search
    • Machine learning
    • Multimedia signal processing

• Deep-learning based multimedia processing
  • Main programming language and library
    • Java/C++/Python
    • Torch7: learning library that supports neural net training (http://www.torch.ch/)
  • Main algorithms
    • GPU computation
    • Deep learning
    • Multimedia signal processing
• Symbolic Representation of Time Series for Massive Online Multimedia Learning
  • Main programming language and library
    • Java
    • Weka (http://www.cs.waikato.ac.nz/ml/weka/)
    • MOA (http://moa.cs.waikato.ac.nz/)
  • Main algorithms
    • SAX (http://www.cs.ucr.edu/~eamonn/SAX.htm)
    • Data Stream Mining

• Cloud-based Multimedia Warehouse
  • Main programming language and library
    • Java
    • MySQL
    • Non-SQL Database
    • Apache Hadoop (http://hadoop.apache.org/)
  • Main algorithms
    • Cloud computing
    • Data warehouse
    • Resource management
    • MapReduce