The Center for the Advancement of E-Commerce Technologies (ÆCT) was established in November 1999 at the Faculty of Engineering of CUHK, with the mission to foster excellence in the development of knowledge and tools to facilitate commerce on the Internet. Projects at ÆCT are organized in five tracks:

1. e-commerce centric, Web-enabled technologies;
2. supply chain and logistics management;
3. Web-enabled design and manufacturing;
4. on-line financial services;
5. e-commerce education, training and industrial partnership.

The three focal applications are pillars that support conducting business on the Internet, particularly in terms of coordination with customers, coordination with production and distribution, and coordination with product design. Together, they are the embodiment of ÆCT’s motto: unlock the end-to-end e-commerce value chain.

The main component of Track 5 is CUHK’s (part time) MSc program in E-Commerce, which is jointly administered by the Faculties of Business Administration and Engineering, and has two complementary parts, the Business Program and the Technologies Program. The combined expertise from both faculties covers all key subject areas of e-commerce, resulting in a rich and comprehensive set of courses for students to choose from. In addition, the two faculties have been working with overseas universities to develop joint research projects and exchange programs, and with industry to foster partnership in R&D, training and technology transfer.

The three categories of e-commerce technologies and the three focal applications described above are among the most exciting technological advances of the Internet age. Coupled with programs in e-commerce education, training and industry partnership, they will have a lasting impact on improving the quality of life in this region and well beyond.

David D. Yao
Professor of Systems Engineering and Engineering Management, and Director, ÆCT
Information Navigation with Bilingual Natural Language Queries

**INVESTIGATOR**
Helen Meng, Dept. of Systems Engineering and Engineering Management

**AIM OF THE PROJECT**
Develop a human-computer interface that offers ease-of-access to real-time, decision-critical information related to e-commerce activities. The system supports user queries in natural language, for both English and Cantonese, and provides verbalized responses in a timely and precise manner.

**METHODOLOGIES**
- Natural language parsing with semi-automatically induced grammars;
- Automatic inference of the user's informational goal;
- Natural language response generation from raw data (codes and numeric expression retrieved from the database).

**SCIENTIFIC SIGNIFICANCE**
- A unified approach for handling natural language queries in both English and Chinese – hence improvements to the approach benefit both languages simultaneously;
- Semi-automatic grammar induction expedites manual grammar development process (by expert grammarians);
- Data-driven techniques (in grammar development and informational goal inference) models real-world data well.

**PRACTICAL VALUE**
- End-users can formulate queries for information retrieval with ease (ease-of-access);
- Bilingual interface suits Hong Kong's language environment;
- Automated, data-driven techniques enhances the portability of the approach across application domains and across languages;
- Potential in integration with speech recognition / synthesis technologies.

**REFERENCES**

Security for Rich-Media Mobile E-Commerce

**INVESTIGATORS**
Victor K. Wei, Dept. of Information Engineering

**AIM OF THE PROJECT**
To research security technologies and tools for rich-media mobile e-commerce.

**METHODOLOGIES**
- General security technologies and tools, including firewall, anti-virus, PKI, 3A, employee monitoring, anti-hacking, content filtering, and physical separation;
- Rich-media mobile e-commerce, including multi-media coding techniques and mobile transmission and networking technologies.

**SCIENTIFIC SIGNIFICANCE**
- Various topics in advanced cryptography, including Schoof algorithm and elliptic curve generation, attack database for integer factorization;
- Advanced security topics in e-commerce payment systems, including interest-bearing e-cash, micro-payment, debit/credit/ATM systems.

**PRACTICAL VALUE**
- Security is a cornerstone enabling technology, and rich-media mobile e-commerce has tremendous market potential.

**REFERENCES**
Digital Video Libraries for Next Generation Broadband and Wireless Internet

INVESTIGATORS
Michael R. Lyu, Dept. of Computer Science and Engineering; Wing Wong, Dept. of Information Engineering; Jerome Yen, Dept. of Systems Engineering and Engineering Management.

AIM OF THE PROJECT
To develop techniques for multilingual, multimedia digital video content creation, management, and integration.

Methodologies
- Automated transcription via multilingual speech recognition;
- Information retrieval engines for multilingual multimedia libraries;
- Multimodal query: Including imagery along with text;
- On-demand summarization and synthetic documents from retrieved content;
- Video management over broadband networks;
- Quality of service for wireless connections.

Scientific significance
- Automated information extraction from video;
- Full-content search and retrieval from all spoken language and visual documents;
- Integration of speech, image and natural language understanding for library creation and exploration.

Practical value
- Out-reaching for wider group of media viewers;
- Attracting more people in creating media content;
- Generating demands for broadband access;
- Supporting e-commerce applications;
- Facilitating education and cultural exchange.

References

A Smart Card System with Biometrics Capability

INVESTIGATOR
Y. S. Moon, Dept. of Computer Science and Engineering

AIM OF THE PROJECT
To construct a secure platform for e-commerce activities by using smart card and fingerprint.

Methodologies
- The verification process is done using a distributed algorithm involving the smart card processor and the processor of a trusted host PC;
- Used a new type of smart card, which is equipped with a 32-bit Java processor that allows easy Internet access.

Scientific significance
- Implementation of the fingerprint matching algorithm in real time using a 5 M Hz smart card processor.

Practical value
- Owner’s fingerprint is not exported from the smart card, enhancing security measure and user confidence;
- Useful applications in on-line financial services and other high-security transactions.

References
e-jing: Technology and Solutions for B2B E-Commerce

INVESTIGATORS
Houmin Yan and David D. Yao, Dept. of Systems Engineering and Engineering Management

AIM OF THE PROJECT
An electronic infrastructure and software solution to enable B2B e-commerce and to integrate supply chain decisions into corporations' procurement, out-sourcing and sales processes.

METHODOLOGIES
• A three-tier system architecture;
• XML-based input and output design to facilitate connections across entities;
• Indexed database search to maximize efficiency;
• Dynamic, hierarchical data structure BOM creation.

SCIENTIFIC SIGNIFICANCE
• Synchronized English and Chinese (traditional/simplified) versions;
• Advanced catalog management tools;
• Customized workflow/document management;
• Collaborative planning and customer relationship management;
• Intelligent decision support for supply chain management.

PRACTICAL VALUE
• Systematic/spot procurement/sales for direct/indirect materials/resources, especially for companies with short product life-cycle and complex material requirements;
• Also, a useful tool for both e-market makers and solution providers.

REFERENCES
http://www.aect.cuhk.edu.hk/e-jing

Web-Based Virtual Design

INVESTIGATORS
K. C. Hui, Dept. of Automation and Computer-Aided Engineering

AIM OF THE PROJECT
A real-time modelling system for virtual design, which allows interactive deformation of a virtual object.

METHODOLOGIES
• Virtual sculpting based on modelling techniques;
• Deformation of solid model using axial and freeform deformation techniques;
• Interactive deformation of shapes using axial curve-pair and the axial skeletal representation.

SCIENTIFIC SIGNIFICANCE
• Enhancing the computation of elastic deformation through parallel processing;
• The continuity of complex surfaces in a deformation process is maintained;
• The axial skeletal representation provides a platform for developing high level shape operations.

PRACTICAL VALUE
• Provide a tool for interacting with objects in a virtual environment;
• Allow interactive and intuitive complex shape changes;
• Suitable for web-based character animation, which is essential for web-based advertisement and video game design.

REFERENCES
Map-Based Logistics Support for Mobile Commerce

Investigators
Ch. Cheng and Janny Leung, Dept. of Systems Engineering and Engineering Management

Aim of the Project
To develop a logistics decision system that supports bilingual location-based on-line queries from clients using mobile devices. The delivery-planning module will support order assignment and vehicle routing that allows dynamic re-routing using time-based information, adaptable to handle the traffic congestion and population density of Hong Kong.

System Design and Methodologies
• Bilingual interface;
• Multi-layered map representation of road networks;
• Dynamic vehicle routing, stochastic programming, on-line algorithms.

Scientific Significance
• Extension of vehicle routing methods to networks with time-varying and random arc-lengths;
• Database representation of dynamic networks.

Practical Value
• Extend the heuristics, metaheuristics, mixed-integer programming solutions, etc. in vehicle routing and scheduling to the real Hong Kong road network;
• To interface with planned HKSAR Government initiatives, e.g.:
  • Traffic Information Systems (TIS)(will be formed in 2003);
  • Traffic Management and Information Centre (TMIC)(will be formed in 2006).

References
http://seis01.se.cuhk.edu.hk/vans

“E-INTEGRATOR” An Intelligent Engine in a BXB for Air Cargo Logistics

Investigators
Lawrence C. Leung, Waiman Cheung, Y.V. Hui, and Alex Chu, Center of Cyber Logistics, Faculty of Business Administration

Aim of the Project
To develop a decision support engine, the E-integrator, within a B2B platform for air cargo logistics. The engine has the capability to integrate, consolidate, and optimize activities of various agents of the air cargo industry.

Methodologies
• System prototyping (incorporating intelligent mechanism into a B2B platform);
• Mixed 0-1 integer optimization model (Optimizing Interrelated e-logistics transactions online).

Scientific Significance
A B2B-Exchange (BXB) platform that extends the business process integration concept of individual enterprises to the industry level.

Practical Value
With the BXB Platform, agents in the air cargo industry can engage in information seeking, negotiation, and settlement, as well as perform all aspects of process design, consolidation, and integration.

References:
**A Few Good Stocks – The Tale of On-Line Index Tracking**

**Investigators**
David D. Yao, Shuzhong Zhang, and Xun Yu Zhou; Dept. of Systems Engineering and Engineering Management

**Aim of the Project**
A real-time financial decisions system for on-line financial service. The particular function of the system is to form a portfolio with a small amount of stocks, such that the value of the portfolio tracks a given stock index.

**Methodologies**
- Stochastic linear quadratic control model with singular cost matrices;
- Bridge singular SLQ Control with Semi-definite Programming;
- Solve the resulting Semi-definite Programming by high performance Interior Point Method.

**Scientific Significance**
- Extension of the Nobel prize winning mean-variance model of Markowitz;
- Continuous-time framework, reflecting the dynamic nature of the asset market;
- A computable solution for controlling a large-size, stochastic dynamic system.

**Practical Value**
- Real-time solvability; decision support for on-line trading;
- Rocket science (guided missile technology) made easy for both fund managers and individual investors.

**References**

**Concurrent Text and Time Series Mining to Predict Stock Trend**

**Investigators**
Jeffrey Xu Yu and Wai Lam, Dept. of Systems Engineering and Engineering Management

**Aim of the Project**
To investigate a new technology that can assist the prediction of stock trends based on a large amount of news stories and other data available on the Web.

**Methodologies**
- Automatic text categorization, hot-topic detection, text mining;
- Time-series analysis, sequential mining;
- Concurrent text and time-series mining.

**Scientific Significance**
- A new research area that combines two interrelated but different subjects;
- Prediction of stock trends based on news stories with a hierarchical structure;
- Analysis of the impacts of news stories on stocks.

**Practical Value**
- Suitable for many on-line financial applications.

**References**
Data Fusion, Data Mining and Decision Support for Bank Marketing

INVESTIGATORS

AIM OF THE PROJECT
To develop a complete information system as a reference model to demonstrate the potentials of data mining technology in uncovering the hidden yet valuable information for bank decisions and marketing.

METHODOLOGIES
• To perform customer segmentation through the navigation of a large-scale enhanced database;
• Data fusion and data cleansing;
• Decision support for clustering, classification and forecasting customer/market data.

SCIENTIFIC SIGNIFICANCE
• Applying data mining and other AI techniques to marketing and banking decisions.

PRACTICAL VALUE
• Better banking and non-banking products and services can be developed to meet customer needs.
• New business areas such as e-marketing can be more effectively introduced and developed.

REFERENCES
http://itf.gov.hk/secure/general.asp

The Term Structure of Credit Spread

INVESTIGATOR
Jia He, Wenwei Hu

AIM OF THE PROJECT
An extensive exploration for the credit spread term structure. The term structure curves shape and relationship between credit spread curves and credit ratings are examined. The dynamics of spread curves is also studied.

METHODOLOGIES
• Using reduced-form models to price credit risk from default rates and recovery rates
• Developing a bond pair approach to extract segmented slopes and analyze curvatures
• Conducting statistical tests on individual firms bonds’ credit spread curves
• Determining factors to move the spread curves dynamically

SCIENTIFIC SIGNIFICANCE
• A comprehensive empirical investigation about credit risk term structure
• Building the relationships among credit curves with different ratings
• Improving the current credit risk models, including the famous JP Morgan’s CreditMetrics method, which is used to estimate credit-risky assets’ prices

PRACTICAL VALUE
• To accurately pricing credit risk and credit-risky assets
• To accurately estimate future prices of credit-risky assets
• To judge credit quality and credit cycle

REFERENCE
• Wenwei Hu, The Term Structure of Credit Risk, doctoral dissertation, Chinese University of Hong Kong, August 2000, Hong Kong.
An XML-based Data Interchange and Personalization System for Frictionless eTourism

Investigators
Alan C. B. Tse, Dept. of Marketing

Aim of the Project
To develop an innovative XML-based portal to enable overseas tourists or their agents to design and book their itinerary through a web-enabled device.

Methodologies
• XML-based Tourist System:
  • Personalization agent identifies products/services that may appeal to the user – the preliminary evoked set.
  • Collaborative filtering system fine-tunes the evoke set.
  • User profile, product choice details and log file information are transformed and inserted into the tourist database.
• Data Mining System:
  • An algorithm mines the tourist database to produce association rules. The rules are stored as XML documents.
  • XML-based Supplier System:
  • Tourist product/service providers enter information via XML-based interfaces generated by specific DTDs.
  • Provider information inserted into supplier database.
  • Registered providers are allowed access to association rules.
  • They may be granted restricted access to the tourist database.
  • Linkage with other application systems.

Scientific significance
• The system provides an open standard for the exchange of tourist information in on-line transactions.
• It provides the platform for researchers to test models of online consumer behaviour and marketing practices.

Practical value
• Overseas tourists or their agents can design and book their itinerary through a web-enabled device.
• Suppliers of tourist services can uncover useful knowledge about tourists. Documents may potentially interface with their internal database and/or EDI systems.

Web Traffic Measurement

Investigators
Thomas Tsui and David Choi, Information and Technology Services Center; Kin-nam Lau, Dept. of Marketing; and Pui Lam Leung, Dept. of Statistics

Aim of the Project
To measure web traffic for all Internet Content Providers using mass volume of data from various sources.

Methodologies
• Data mining approach;
• Statistical modeling.

Scientific significance
• Analyzing and integrating massive volume of data from different sources;
• Solving the missing value problems.

Practical Value
• Providing independent and unbiased reports on Web Traffic for ICP with most reliable data available in the internet;
• Setting standard to measure web traffic for the web industry.

References
• Jesus Mena, "Data Mining Your Web Site."
E-Commerce and E-Government: An Audit

**INVESTIGATORS**
Jerome Yen and Wai Lam, Dept. of Systems Engineering and Engineering Management

**James Xie, School of Accountancy**

**Aim of the Project**
To assess how effective, efficient, and transparent the Hong Kong SAR Government has prepared itself and the local community to cope with the development of e-commerce.

**Methodologies**
- Study the procedures of setting up the requirements, measurements, and standards that relate to the public key infrastructure (PKI) and electronic service delivery (ESD);
- Analyze the measures by cost/benefit analysis and compare them against performance measures from other countries, for example, Singapore and Canada;
- Study the adoption and diffusion of e-commerce in government sectors, which include the use and penetration of information technologies that support e-commerce;
- Identify the barriers in the adoption of e-commerce, which include, strategic, technical, operational, and political, and identify possible solutions to remove such barriers.

**Scientific Significance**
- Building an efficient e-government and creating a conducive environment to support e-commerce are complex and challenging issues. This will be among the first scientific study on e-government, using statistical techniques, accounting methodologies, as well as qualitative analysis.

**Practical Value**
- Improve market transparency and efficiency.
- Assist informed decision-making
- Encourage market participants

**References**

Cross Market Monitoring System

**INVESTIGATORS**
Shuzhong Zhang, Wai Lam, Jerome Yen, and Jeffrey Yu; Dept. of Systems Engineering and Engineering Management

**Aim of the Project**
To develop a prototype cross market monitoring system, aimed at improving the information transparency and efficiency.

**Methodologies**
- Three-stage model: alarm signalling, tracing and linking, and decision support;
- Real-time monitoring of broker and market activities, and external events;
- Information filtering;
- Constructing and identifying key arbitrage measures;
- Visualization of numerical and textual data.

**Scientific Significance**
- Combining FE and AI techniques;
- Combining textual and numerical data analysis.

**Practical Value**
- Improve market transparency and efficiency.
- Assist informed decision-making
- Encourage market participants

**References**
Faculty of Business Administration
Faculty of Engineering
The Chinese University of Hong Kong
Forward from Professor David D. Yao, Director of AECT

**Selected projects**

4. Information Navigation with Bilingual Natural Language Queries
6. A Smart Card System with Biometrics Capability
7. Digital Video Libraries for Next Generation Broadband and Wireless Internet
8. e-jing: Technology and Solutions for B2B E-Commerce
9. Web-based Virtual Design
10. Map-Based Logistics Support for Mobile Commerce
11. "E-INTEGRATOR” An Intelligent Engine in a BXB for Air Cargo Logistics
12. A Few Good Stocks - The Tale of On-Line Index Tracking
13. Concurrent Text and Time Series Mining to Predict Stock Trends
14. Data Fusion, Data Mining and Decision Support for Bank Marketing
15. The Term Structure of Credit Spread
16. An XML-based Data Interchange and Personalized System for Frictionless eTourism
17. Web Traffic Measurement
18. Cross Market Monitoring System
19. E-Commerce and E-Government: An Audit