Intelligence and Security Driven Distributed Systems

Ruixuan Li

Huazhong University of Science and Technology
Wuhan, China

http://idc.hust.edu.cn/~rxli/
CS at HUST

- College of Computer Science and Technology
- 4 departments
  - Computer Science
  - Computer Engineering
  - Computer Application
  - Information Security
- 184 faculty, 30+ staff
- Top 10 of CS in China
  - 9 (2006)
14 Faculty:
  3 full professors
  5 A/Profs
  6 lectures

Over 70 PhDs & Masters
Relationship

- Universities
  - University of Illinois at Urbana-Champaign (Computer Vision)
  - University of College London (Watermarking)
  - University of Toronto (Distributed Systems)
  - Concordia University (Security)
  - George Mason University (Security)
  - Clemson University (P2P)
  - Queen's University Belfast (IR)
  - Macquarie University (Security)
  - University of Western Sydney (Logic)
  - City University of Hong Kong (Distributed Systems)
  - ...

- Industries
  - IBM, Microsoft, Oracle, SCO, Tencent, Netease, …
Research Grants

- Grants in 2004-2009
  - 8 NSFC grants
  - 3 National Hi-Tech R&D Program of China (863) grants
  - 4 National Key Tech R&D Program of China grants
  - 3 grants from Ministry of Information Industry
  - Over 10 other grants from Ministry of Science and Technology, Hubei Province, Huawei Corp, etc

- Funding in 2004-2009: over 10M RMB
  - 3.5M RMB in 2008
Research Output

• Publications
  ◦ Over 300 publications
  ◦ IEEE TKDE, IEICE Trans, Comp J, Info Sci, Comp Comm, IJSEKE, IJCSSE, IJPEDS, IJCNSS
  ◦ ACM MM, CVPR, ICPR, CIKM, ACM SAC, ICME, ICIP, ICTAI, ISC, DEXA, SCC
  ◦ Science in China, JCST

• Patents
  ◦ 18 patents (12 pending)

• Software copyrights
  ◦ 9 software copyrights
Research Fields

Interoperability

Policies

Resources

Security and availability

Secure interoperability

Sharing
Research Fields

Interoperability
Policies
Resources

Sharing, integration, interoperation
Structure, semantic, security
Database, text, multimedia

Infrastructure
Research Fields

- Resource sharing in peer-to-peer network
- Semantic search
- Link analysis & link mining
- Secure interoperability in distributed systems
- Watermarking & DRM
- Intelligent multimedia
P2P Group
Key Issues

- Topology Maintenance
- Searching Scheme (Routing Protocol)
- Data Dissemination Scheme
- Buffer Management
- Security and Reputation
Our Experiences on P2P

- PeerLib
  - A P2P-based Digital Library
  - http://idc.hust.edu.cn/peerlib/

- WebPeer
  - A Web Services Oriented P2P System
  - http://idc.hust.edu.cn/webpeer/

- CoEdit
  - A P2P Based Collaborative Editing System
  - http://idc.hust.edu.cn/coedit/
PeerLib Architecture
PeerLib Prototype

![PeerLib Prototype Image]

- [Image of PeerLib Prototype]
- [List of files and documents related to PeerLib Prototype]
WebPeer: Motivation

- Disadvantages of Web Services
  - Single Node Failure
  - UDDI Bottleneck
  - Limited Scalability
  - Denial of Service (DoS) Attack

- Advantages of Peer-to-Peer
  - Sharing plentiful resources and services among network edges
  - Federated cooperation among companies
  - Having Lower costs of system maintenance
  - Fault tolerance & load balance
Combination of the Two Technologies

- Using P2P-based technologies to publish and discover Web Services
  - Combination of centralized and decentralized characteristics
  - The node providing web services act as a peer
  - Each peer can request web services from other peers
  - Extend the reliability and scalability of the current web services architecture
WSOP: Web Services Oriented Peer-to-peer Architecture

Service Requestor → Bind → Service Provider

Find → Common Service Registry Broker → Publish

Local Service Registry Broker

Super Peer

Peer 1 → Peer 2 → Peer 3

Peer Group 1

Peer Group 2

Local Service Registry Broker

Super Peer

Peer 1 → Peer 2 → Peer 3
WebPeer: System Interfaces

![WebPeer System Interfaces Diagram]

Message Window:

Sending a Web Services Discovery Message over new PeerGroup...
Sending a Web Services Discovery Message over new PeerGroup...
Sending a Web Services Discovery Message over new PeerGroup...
Added to the Web Services Table.
Added to the Web Services Table.
Added to the Web Services Table.
The thread of Web Services searching is stopped!

Huazhong University of Science and Technology
CoEdit: Motivation

- **Collaborative Editing** is a form of Editing which involves a group editing process.

- **Scenario**: Cartographers, designers and drawers fulfill drawing objectives, through sharing resources, context and group interaction.
CoEdit: Issues

- **Session Management:** How do distributed users create, destroy, join and leave collaborative sessions?

- **Concurrency Control:** How do we ensure that concurrent users do not enter inconsistent commands, or merge concurrent commands entered by different users?

- **Undo/Redo:** What are the semantics of undo/redo in a collaborative session?

- **Awareness:** How are users made aware of “out of band” activities of their collaborator?

- **Access Control:** How do we ensure that users do not execute unauthorized commands?

- **Other Aspects:** …
CoEdit: Our Approach

- Enhance the efficiency and performance through employing P2P technology
  - Centralized and decentralized architecture
  - Direct communication between collaborative sites
  - Message routing in the collaborative group
  - Access control among different peers
Grants of P2P Group

- Percolation-Based Topology Control and Search in Peer-to-Peer Network (Supported by NSFC)

- Scale-Free Network Model in Semantic Overlay Network (Supported by Chenguang Program of Wuhan Municipality)
Publications


Semantic Search Group
Research Issues

- Semantic search conceptual model
- Ontology knowledge construction, maintenance and evolution
- Reasoning mechanisms
- Result ranking
Our Experiences on Semantic Search

- Smartch: Reasoning and Search
- SAS: Semantic Association Search
- Reasoning System Based on Description Logic
- Ontology Management Tool
Smart Search: Smartch

- Three functions:
  - Basic search
  - Concept search
  - Graphic mode search

- Characteristics:
  - Domain specific
  - **Reasoning + search** — different from traditional keyword search
  - Better expression — customized graphical way
  - Digging deeper information — search relationship
Architecture of Smartch

```
| Repository | Reasoning Engine | Interface Engine | Crawler | Resources |
```

Semantic Search

Internet
Smartch: Basic search

http://idc.hust.edu.cn/seseek/

Oracle Developer 2000 学习教程

Some useful notes on how to prepare and deliver a good presentation

... You will present a paper in equally to all...
Smarth: User-Defined Graphics Mode

http://idc.hust.edu.cn/seseek/
Semantic Association Search

Semantic Association Search (SAS)

Length weight: 0.3  Long Association Prior
Context weight: 0.3  Node In&Out weight: 0.4

Start Node: http://www.w3.org/1999/02/22-rdf-syntax-ns# r1
End Node: http://www.w3.org/1999/02/22-rdf-syntax-ns# r9

Show Explanation  Search  Reset

Please select the classes you want to emphasize:
- http://www.owl-ontologies.com/semrank/ow#Flight
- http://www.w3.org/2002/07/owl#Nothing
- http://www.owl-ontologies.com/semrank/ow#Course
- http://www.owl-ontologies.com/semrank/ow#TA
- http://www.owl-ontologies.com/semrank/ow#Professor
- http://www.owl-ontologies.com/semrank/ow#Passenger
- http://www.owl-ontologies.com/semrank/ow#Credit_Card
- http://www.owl-ontologies.com/semrank/ow#Account
Semantic Association Search

Time: 390 ms. Existing 6 semantic association relationship.

http://www.owl-ontologies.com/semrank.owl#r1 and http://www.owl-ontologies.com/semrank.owl#r9 have following association relationship:

1. r1 depositsInto r8 AcctHolder r6 ownsStockIn r9
   Total Value: 0.40803033

2. r1 adviseeof r5 ownsStockIn r9
   Total Value: 0.39767677

3. r1 ownsStockIn r5 electedLeader r6 ownsStockIn r9
   Total Value: 0.39666668

4. r1 bitsFor r2 forFlight r3 paidBy r4 AcctHolder r5 electedLeader r6 ownsStockIn r9
   Total Value: 0.38497838

5. r1 audits r7 taughtBy r6 ownsStockIn r9
   Total Value: 0.3830303

Result pages: 1 2 Next page
Semantic Association Search

1. 孙小林 指导教师 卢正鼎
   Total Value: 0.42523062

2. 孙小林 发表著作 基于本体的多域访问控制策略集成研究 作者 文传信 指导教师 卢正鼎
   Total Value: 0.24529517

3. 孙小林 发表著作 基于本体的多域访问控制策略集成研究 作者 文传信 发表著作 paper005 作者 卢正鼎
   Total Value: 0.20952154

4. 孙小林 发表著作 基于本体的多域访问控制策略集成研究 作者 文传信 发表著作 paper005 作者 周晓阳 指导教师
   Total Value: 0.184663

5. 孙小林 发表著作 基于本体的多域访问控制策略集成研究 在Javac环境下实现可插入的认证及访问控制 作者 卢正鼎
   Total Value: 0.17508751

6. 孙小林 发表著作 基于本体的多域访问控制策略集成研究 paper003 作者 卢正鼎
   Total Value: 0.17483343

7. 孙小林 发表著作 基于本体的多域访问控制策略集成研究 一种Peer-to-Peer环境下分布式访问控制模型 作者 卢正鼎
   Total Value: 0.17481378
DL-based Reasoning System
DL-based Reasoning System

```
rdfs:comment "";
rdfs:label "quality broadsheet";
rdfs:subClassOf ns0:broadsheet.

ns0:cow
  a owl:Class;
rdfs:comment "Cows are naturally vegetarians.";
rdfs:label "cow";
rdfs:subClassOf ns0:vegetarian.

ns0:animal_lover
  a owl:Class;
rdfs:comment "Someone who really likes animals";
rdfs:label "animal lover";
owl:equivalentClass
  [ a owl:Class;
    owl:intersectionOf (ns0:person [ a owl:Class ;
          owl:minCardinality "3"^^xsd:nonNegativeInteger
        ];
        owl:onProperty ns0:has_pet
      ) ];
```
Ontology Management Tool
Grants of Semantic Search Group

- 2006-2007, Semantic Search based on Ontology Repository Reasoning. *(Supported by Huawei Corp. under grant YBINT006089)*

- 2009-2010, Semantic Search Based on Retrieval and Reasoning. *(Supported by National Key Lab. Open Foundation of China under grant SKLS20080718)*

- 2009-2010, Research on semantic search based on social annotation in special domain. *(Supported by Youth Innovation Fund of Huazhong University of Science and Technology)*
Publications

Patents

- System for Topic Crawler Based on Social Annotations. China Patent (pending, application No. 200910062020.0), 2009
- System for Website Oriented Secure Database Search Engine. China Patent (pending, application No. 200810048012.6), 2008
Data Mining Group
Research Interests

- Dynamic social network models
- Community detection
- Graph pattern mining and query
- Graph classification
- Link prediction
Research Issues

- Social network models
  - Hidden Markov model
  - Dynamic weighted directed graphs

- Community detection algorithms
  - A well designed genetic algorithm to solve maximum likelihood problem
  - StreamGroup: to discover time-evolving communities and to detect change-points
Research Issues

• **Graph pattern mining and query**
  ◦ Mining frequent graph pattern with direction, label, weight
  ◦ Mining frequent graph pattern in graph stream
  ◦ Mining top-k frequent graph pattern
  ◦ Graph pattern query and answer
Research Issues

- Knowledge engineering
  - Distributed knowledge discovery framework
  - Semantic data integration based on privacy protection
  - Data mining ontology development
  - Data mining service selection in SOA
Research Issues

- Semantic Search Combining Social Annotation
  - Extracting semantic information from social annotation
  - Social network based on social annotation
  - Semantic search model combining social annotation
  - Methods for ranking search results based on social annotation
iCon: Conference Search System

• Research issues:
  ◦ Web information extraction (Event extraction)
  ◦ Information integration

• Objective:
  ◦ To provide an academic conference information extraction, integration, search and distribution system which is a convenient, easy-to-use and full-scale information system in the field of the computer science and technology.
iCon: Sources Integrated

(1) **DBLP Computer Science Bibliography**

(2) **Microsoft Libra Conferences**

(3) **WikiCFP**

(4) **Computer Science Conference Ranking**
   [http://www3.ntu.edu.sg/home/ASSourav/crank.htm](http://www3.ntu.edu.sg/home/ASSourav/crank.htm)

(5) **Computer Science Conference Ranking** [http://www.cs-conference-ranking.org](http://www.cs-conference-ranking.org)

(6) **CiteSeer Estimated Venue Impact Factors**
   [http://citeseerx.ist.psu.edu/stats/venues](http://citeseerx.ist.psu.edu/stats/venues)

(7) The Grid Laboratory that belongs to the Huazhong University of Science and Technology **Call for Papers**

(8) Some special issues of international journals
# iCon: Prototype System

## UpComing Events

<table>
<thead>
<tr>
<th>Event</th>
<th>Deadline</th>
<th>Notification</th>
<th>Date</th>
<th>Location</th>
<th>Publisher</th>
<th>Rank</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>WAOA 2009</td>
<td>06/08/2009</td>
<td>07/15/2009</td>
<td>09/10/2009-09/11/2009</td>
<td>Copenhagen, Denmark</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>KESE 2009</td>
<td>06/08/2009</td>
<td>07/08/2009</td>
<td>09/15/2009-09/16/2009</td>
<td>Padsborn, Germany</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>VRST 2009</td>
<td>06/10/2009</td>
<td>N/A</td>
<td>N/A</td>
<td>Kyoto, Japan</td>
<td>ACM</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>AIDC 2009</td>
<td>06/10/2009</td>
<td>N/A</td>
<td>N/A</td>
<td>Kyoto, Japan</td>
<td>ACM</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>
## iCon: Prototype System

### Conferences

<table>
<thead>
<tr>
<th>Event</th>
<th>Deadline</th>
<th>Notification</th>
<th>Date</th>
<th>Location</th>
<th>Publisher</th>
<th>Rank</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVPR 2009</td>
<td>11/20/2008</td>
<td>N/A</td>
<td>06/20/2009 — 06/26/2009</td>
<td>Miami Beach Florida</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACL-SRW 2009</td>
<td>02/22/2009</td>
<td>04/12/2009</td>
<td>08/02/2009 — 08/07/2009</td>
<td>Singapore Singapore</td>
<td></td>
<td></td>
<td>1.44</td>
</tr>
<tr>
<td>ACL 2008</td>
<td>02/10/2008</td>
<td>02/28/2008</td>
<td>06/15/2008 — 06/20/2008</td>
<td>Columbus Ohio</td>
<td></td>
<td></td>
<td>1.44</td>
</tr>
<tr>
<td>ACL 2008</td>
<td>01/10/2008</td>
<td>02/28/2008</td>
<td>06/15/2008 — 06/20/2008</td>
<td>Columbus Ohio</td>
<td></td>
<td></td>
<td>1.44</td>
</tr>
<tr>
<td>ACL demos 2008</td>
<td>03/14/2008</td>
<td>04/14/2008</td>
<td>06/15/2008 — 06/20/2008</td>
<td>Columbus Ohio USA</td>
<td></td>
<td></td>
<td>1.44</td>
</tr>
<tr>
<td>IJCNLP 2009</td>
<td>02/22/2009</td>
<td>04/12/2009</td>
<td>08/02/2009 — 08/07/2009</td>
<td>Singapore</td>
<td></td>
<td></td>
<td>1.44</td>
</tr>
<tr>
<td>DASFAA 2009</td>
<td>10/03/2008</td>
<td>12/12/2008</td>
<td>04/21/2009 — 04/23/2009</td>
<td>Cambridge, Australia</td>
<td></td>
<td></td>
<td>0.28</td>
</tr>
<tr>
<td>COLING 2008</td>
<td>03/30/2008</td>
<td>05/30/2008</td>
<td>08/18/2008 — 08/22/2008</td>
<td>Manchester UK</td>
<td></td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>CAIP 2009</td>
<td></td>
<td></td>
<td></td>
<td>13th International Conference on Computer Analysis of Images and Patterns</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## iCon: Prototype System

### Tags

<table>
<thead>
<tr>
<th>Tag</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>artificial intelligence</td>
<td>238</td>
</tr>
<tr>
<td>NLP</td>
<td>216</td>
</tr>
<tr>
<td>communications</td>
<td>215</td>
</tr>
<tr>
<td>databases</td>
<td>214</td>
</tr>
<tr>
<td>networking</td>
<td>159</td>
</tr>
<tr>
<td>web</td>
<td>142</td>
</tr>
<tr>
<td>software engineering</td>
<td>133</td>
</tr>
<tr>
<td>information retrieval</td>
<td>111</td>
</tr>
<tr>
<td>HCI</td>
<td>111</td>
</tr>
<tr>
<td>data mining</td>
<td>109</td>
</tr>
<tr>
<td>machine learning</td>
<td>96</td>
</tr>
<tr>
<td>software</td>
<td>93</td>
</tr>
<tr>
<td>multimedia</td>
<td>90</td>
</tr>
<tr>
<td>wireless</td>
<td>77</td>
</tr>
<tr>
<td>computer</td>
<td>75</td>
</tr>
<tr>
<td>image processing</td>
<td>75</td>
</tr>
<tr>
<td>robotics</td>
<td>68</td>
</tr>
<tr>
<td>computer vision</td>
<td>68</td>
</tr>
<tr>
<td>computer graphics</td>
<td>66</td>
</tr>
<tr>
<td>circuits</td>
<td>65</td>
</tr>
<tr>
<td>systems</td>
<td>63</td>
</tr>
<tr>
<td>control</td>
<td>61</td>
</tr>
<tr>
<td>computer architecture</td>
<td>60</td>
</tr>
<tr>
<td>embedded systems</td>
<td>58</td>
</tr>
<tr>
<td>semantic web</td>
<td>56</td>
</tr>
<tr>
<td>bioinformatics</td>
<td>53</td>
</tr>
<tr>
<td>distributed systems</td>
<td>53</td>
</tr>
<tr>
<td>automation</td>
<td>50</td>
</tr>
<tr>
<td>simulation</td>
<td>47</td>
</tr>
<tr>
<td>programming languages</td>
<td>44</td>
</tr>
<tr>
<td>nanotechnology</td>
<td>41</td>
</tr>
<tr>
<td>information systems</td>
<td>40</td>
</tr>
<tr>
<td>information technology</td>
<td>39</td>
</tr>
<tr>
<td>computer science</td>
<td>38</td>
</tr>
<tr>
<td>life sciences</td>
<td>37</td>
</tr>
<tr>
<td>pattern recognition</td>
<td>37</td>
</tr>
<tr>
<td>semantics</td>
<td>37</td>
</tr>
<tr>
<td>industrial electronics</td>
<td>36</td>
</tr>
<tr>
<td>sensor networks</td>
<td>36</td>
</tr>
<tr>
<td>internet</td>
<td>35</td>
</tr>
<tr>
<td>algorithms</td>
<td>34</td>
</tr>
<tr>
<td>environment</td>
<td>33</td>
</tr>
<tr>
<td>web 2.0</td>
<td>33</td>
</tr>
<tr>
<td>ontology</td>
<td>33</td>
</tr>
<tr>
<td>biomedical engineering</td>
<td>31</td>
</tr>
<tr>
<td>mobility</td>
<td>29</td>
</tr>
<tr>
<td>e-commerce</td>
<td>29</td>
</tr>
<tr>
<td>computational linguistics</td>
<td>29</td>
</tr>
<tr>
<td>engineering</td>
<td>28</td>
</tr>
<tr>
<td>education</td>
<td>28</td>
</tr>
<tr>
<td>IR</td>
<td>28</td>
</tr>
<tr>
<td>modeling</td>
<td>28</td>
</tr>
<tr>
<td>computation theory</td>
<td>27</td>
</tr>
<tr>
<td>design automation</td>
<td>27</td>
</tr>
<tr>
<td>communication</td>
<td>26</td>
</tr>
<tr>
<td>cognitive science</td>
<td>26</td>
</tr>
<tr>
<td>biology</td>
<td>25</td>
</tr>
<tr>
<td>electro-optics</td>
<td>24</td>
</tr>
<tr>
<td>lasers</td>
<td>24</td>
</tr>
<tr>
<td>biotechnology</td>
<td>24</td>
</tr>
<tr>
<td>measurement</td>
<td>24</td>
</tr>
<tr>
<td>chemistry</td>
<td>23</td>
</tr>
<tr>
<td>e-learning</td>
<td>23</td>
</tr>
<tr>
<td>computer security</td>
<td>22</td>
</tr>
<tr>
<td>communication</td>
<td>22</td>
</tr>
<tr>
<td>software engineering</td>
<td>22</td>
</tr>
<tr>
<td>security</td>
<td>118</td>
</tr>
<tr>
<td>signal processing</td>
<td>107</td>
</tr>
<tr>
<td>wireless</td>
<td>82</td>
</tr>
<tr>
<td>robotics</td>
<td>75</td>
</tr>
<tr>
<td>embedded systems</td>
<td>58</td>
</tr>
<tr>
<td>semantic web</td>
<td>56</td>
</tr>
<tr>
<td>bioinformatics</td>
<td>53</td>
</tr>
<tr>
<td>distributed systems</td>
<td>53</td>
</tr>
<tr>
<td>automation</td>
<td>50</td>
</tr>
<tr>
<td>simulation</td>
<td>47</td>
</tr>
<tr>
<td>programming languages</td>
<td>44</td>
</tr>
<tr>
<td>nanotechnology</td>
<td>41</td>
</tr>
<tr>
<td>information systems</td>
<td>40</td>
</tr>
<tr>
<td>information technology</td>
<td>39</td>
</tr>
<tr>
<td>computer science</td>
<td>38</td>
</tr>
<tr>
<td>life sciences</td>
<td>37</td>
</tr>
<tr>
<td>pattern recognition</td>
<td>37</td>
</tr>
<tr>
<td>semantics</td>
<td>37</td>
</tr>
<tr>
<td>industrial electronics</td>
<td>36</td>
</tr>
<tr>
<td>sensor networks</td>
<td>36</td>
</tr>
<tr>
<td>internet</td>
<td>35</td>
</tr>
<tr>
<td>algorithms</td>
<td>34</td>
</tr>
<tr>
<td>environment</td>
<td>33</td>
</tr>
<tr>
<td>web 2.0</td>
<td>33</td>
</tr>
<tr>
<td>ontology</td>
<td>33</td>
</tr>
<tr>
<td>biomedical engineering</td>
<td>31</td>
</tr>
<tr>
<td>mobility</td>
<td>29</td>
</tr>
<tr>
<td>e-commerce</td>
<td>29</td>
</tr>
<tr>
<td>computational linguistics</td>
<td>29</td>
</tr>
<tr>
<td>engineering</td>
<td>28</td>
</tr>
<tr>
<td>education</td>
<td>28</td>
</tr>
<tr>
<td>IR</td>
<td>28</td>
</tr>
<tr>
<td>modeling</td>
<td>28</td>
</tr>
<tr>
<td>computation theory</td>
<td>27</td>
</tr>
<tr>
<td>design automation</td>
<td>27</td>
</tr>
<tr>
<td>communication</td>
<td>26</td>
</tr>
<tr>
<td>cognitive science</td>
<td>26</td>
</tr>
<tr>
<td>biology</td>
<td>25</td>
</tr>
<tr>
<td>electro-optics</td>
<td>24</td>
</tr>
<tr>
<td>lasers</td>
<td>24</td>
</tr>
<tr>
<td>biotechnology</td>
<td>24</td>
</tr>
<tr>
<td>measurement</td>
<td>24</td>
</tr>
<tr>
<td>chemistry</td>
<td>23</td>
</tr>
<tr>
<td>e-learning</td>
<td>23</td>
</tr>
<tr>
<td>computer security</td>
<td>22</td>
</tr>
<tr>
<td>communication</td>
<td>22</td>
</tr>
<tr>
<td>software engineering</td>
<td>22</td>
</tr>
<tr>
<td>security</td>
<td>118</td>
</tr>
<tr>
<td>signal processing</td>
<td>107</td>
</tr>
<tr>
<td>wireless</td>
<td>82</td>
</tr>
<tr>
<td>robotics</td>
<td>75</td>
</tr>
<tr>
<td>embedded systems</td>
<td>58</td>
</tr>
<tr>
<td>semantic web</td>
<td>56</td>
</tr>
<tr>
<td>bioinformatics</td>
<td>53</td>
</tr>
<tr>
<td>distributed systems</td>
<td>53</td>
</tr>
<tr>
<td>automation</td>
<td>50</td>
</tr>
<tr>
<td>simulation</td>
<td>47</td>
</tr>
<tr>
<td>programming languages</td>
<td>44</td>
</tr>
<tr>
<td>nanotechnology</td>
<td>41</td>
</tr>
<tr>
<td>information systems</td>
<td>40</td>
</tr>
<tr>
<td>information technology</td>
<td>39</td>
</tr>
<tr>
<td>computer science</td>
<td>38</td>
</tr>
<tr>
<td>life sciences</td>
<td>37</td>
</tr>
<tr>
<td>pattern recognition</td>
<td>37</td>
</tr>
<tr>
<td>semantics</td>
<td>37</td>
</tr>
<tr>
<td>industrial electronics</td>
<td>36</td>
</tr>
<tr>
<td>sensor networks</td>
<td>36</td>
</tr>
<tr>
<td>internet</td>
<td>35</td>
</tr>
<tr>
<td>algorithms</td>
<td>34</td>
</tr>
<tr>
<td>environment</td>
<td>33</td>
</tr>
<tr>
<td>web 2.0</td>
<td>33</td>
</tr>
<tr>
<td>ontology</td>
<td>33</td>
</tr>
<tr>
<td>biomedical engineering</td>
<td>31</td>
</tr>
<tr>
<td>mobility</td>
<td>29</td>
</tr>
<tr>
<td>e-commerce</td>
<td>29</td>
</tr>
<tr>
<td>computational linguistics</td>
<td>29</td>
</tr>
<tr>
<td>engineering</td>
<td>28</td>
</tr>
<tr>
<td>education</td>
<td>28</td>
</tr>
<tr>
<td>IR</td>
<td>28</td>
</tr>
<tr>
<td>modeling</td>
<td>28</td>
</tr>
<tr>
<td>computation theory</td>
<td>27</td>
</tr>
<tr>
<td>design automation</td>
<td>27</td>
</tr>
<tr>
<td>communication</td>
<td>26</td>
</tr>
<tr>
<td>cognitive science</td>
<td>26</td>
</tr>
<tr>
<td>biology</td>
<td>25</td>
</tr>
<tr>
<td>electro-optics</td>
<td>24</td>
</tr>
<tr>
<td>lasers</td>
<td>24</td>
</tr>
<tr>
<td>biotechnology</td>
<td>24</td>
</tr>
<tr>
<td>measurement</td>
<td>24</td>
</tr>
<tr>
<td>chemistry</td>
<td>23</td>
</tr>
<tr>
<td>e-learning</td>
<td>23</td>
</tr>
<tr>
<td>computer security</td>
<td>22</td>
</tr>
</tbody>
</table>
# iCon: Prototype System

## Advanced Search

<table>
<thead>
<tr>
<th>Category</th>
<th>Artificial Intelligence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Key_Words Search</td>
<td>Event</td>
</tr>
<tr>
<td>Search options</td>
<td></td>
</tr>
<tr>
<td>Match</td>
<td>fuzzy</td>
</tr>
<tr>
<td>Date</td>
<td>from 2009-06-01 to 2009-08-01</td>
</tr>
<tr>
<td>Deadline</td>
<td>from to</td>
</tr>
<tr>
<td>Location</td>
<td></td>
</tr>
<tr>
<td>Rank</td>
<td>&gt;= 0</td>
</tr>
</tbody>
</table>

**Welcome root**

*Huazhong University of Science and Technology*
Grants in Data Mining Group

- The dynamic financial network analysis technique research basing on link mining (Supported by NSFC, 70771043)
- Decision-making System of The National Foreign Exchange Management (Supported by Key Tech R&D Program, 2001BA102A06-11)
- Instrument device and high quality resource sharing system (Supported by 211 Program)
Publications


- Community Mining on Dynamic Weighted Directed Graphs. to appear in Proceedings of the 18th ACM International Workshop on Information and Knowledge Management (CIKM Workshop), 2009


- Yuhua Li, Quan Lin, Gang Zhong, Dongsheng Duan, Yanan Jin, Wei Bi, A Directed Labeled Graph Frequent Pattern Mining Algorithm based on Minimum Code, the 3rd International Conference on Multimedia and Ubiquitous Engineering (MUE 2009), Qingdao, China, JUNE 2009:353-359

Patents

- A monitoring and analysis method of dynamic financial network (Application No: 200910063081.9)
- System for Topic Crawler Based on Social Annotations. China Patent (pending, application No. 200910062020.0), 2009
Distributed Security Group
Secure Interoperation
Challenges and Solutions

- **Challenges**
  - Heterogeneity in access control policies
  - Security policy optimization
  - Security & availability

- **Solutions**
  - Role mapping
  - Attribute mapping: IUCON
  - Logic programming (CLP)
  - Risk assessment
RBAC-based Secure Interoperation

- How to establish secure interoperability? (Hu & Li, ICISC 2007)
- Formalization of role-based secure interoperability (Hu & Li, TrustCom 2009)
- Theoretic analysis of role-based secure interoperability (Hu & Li, NSS 2009)
Request-Driven Approach

- Request-Driven Role Mapping Framework (Li & Tang’08, International Journal of Computer Systems Science & Engineering)
  - Role mappings based on user requests
  - Flexible policy expression and inter-domain policy mapping
  - Minimal Unique Set (MUS)
    - To perform the privilege query in general hybrid role hierarchies for special external requests
Attribute Mapping Approach

- **IUCON** *(Lu & Li, ISC09)*

- Shortcomings of interoperation based on RBAC
  - Static authorization
  - No further enforcement during the access

- Our approach
  - Attribute mapping based interoperation policy framework
SoD in UCON

- Specification and Enforcement of Static Separation-of-Duty Policies in Usage Control (Lu & Li, ISC 2009)
- Why study SoD in UCON
  - One of RBAC's great advantages is that SoD rules can be implemented in a natural and efficient way
  - UCON has been considered as the next generation access control model
  - SSoD is an important type of SoD
  - UCON_A is a sub-model of UCON only considering authorizations
- A set-based specification scheme for SSoD
Safety & Availability

- Consistency Checking of Safety and Availability in Access Control (*Li & Lu, IEICE Transactions on Information and Systems, 2009*)
  - Safety properties ensuring that users who should not have an access do not get the access
    - E.g., Static Separation-of-Duty Policies
  - Availability properties is about enabling access
    - E.g., Availability Policies
  - The safety and availability policies may conflict with each other due to their opposite focuses
Logic Approach

- Formalization of RBAC-based secure interoperation in Constraint Logic Programming (Hu & Li, TrustCom 2009)
- Managing Authorization Provenance: a Modal Logic Based Approach (Hu & Li, ICTAI 2009)
Risk Assessment

- MD-R\textsuperscript{2}BAC: Risk based dynamic access control (Tang & Li, WISA07)

- R\textsuperscript{2}BAC: Risk & Role Based Access Control (Li & Hu, 2008 Journal on Communications)
  - A fine-grained authorization mechanism is enabled
  - It is possible to monitor users’ behaviors and adjust their permission sets in a real time manner
Security in Database & Information Retrieval

- SeSeek
  - Secure search based on access control
- Mimir
  - Encrypted full-text retrieval
- AD-SDB
  - Andin secure database system
Mimir

http://idc.hust.edu.cn/mimir/
AD-SDB

- Wuhan Huagong Andin Information Technology Co., Ltd
Grants in Distributed Security Group

- Optimization Model for Multi-domain Security Policies Based on Multiple Criteria Decision Making (Supported by NSFC)
- Risk Evaluation Model for Information Exchange Based on Multiple Autonomous Domains (Supported by NSFC)
- Key Technologies of Distributed Ciphertext Information Retrieval System (Supported by 863 Program)
- Encrypted Full Text Retrieval Middleware (Supported by Electronic Information Industry Development Fund of China)
- Key Technologies of Encrypted Full Text Retrieval (Supported by National Cipher Development Fund of China)
- Secure Search Engine Based on Access Control (Supported by Software Development Fund of Hubei Province)
- Risk Assessment Model of Information Sharing across Distributed and Heterogeneous Multi-Domains (Supported by NSF-HB)
- Policy-based Secure Interoperability among Multi-Domains (Supported by SKLSE Open Foundation)
Publications

- Ruixuan Li, Jianfeng Lu, Zhengding Lu, Xiaopu Ma: Consistency Checking of Safety and Availability in Access Control. *IEICE Transactions on Information and Systems*, 2009


Publications (Cont.)


Publications (Cont.)


Patents

- System for Distributed Cipher Full Text Retrieval. China Patent (pending, application No. 200910062129.4), 2009
- System for Website Oriented Secure Database Search Engine. China Patent (pending, application No. 200810048012.6), 2008
- System for Secure Search Engine Based on Access Control. China Patent (No. ZL200710052025.6), 2007
Multimedia Security Group
Background

• Rapid Development of IT
  ◦ Duplication and dissemination of multimedia data become more and more convenient
  ◦ Digital copies with the same quality as original data can be got much more easily and quickly

• Problems:
  ◦ Copyright Piracy
  ◦ illegal use and copyright dissension

• Solution:
  ◦ Watermarking
Watermarking

✓ Imperceptibly added to the cover-signal in order to convey the hidden data

✓ Embedding information into another object/signal
Our Focus

- Challenges
  - How to resist geometric attacks
  - Collusion-resistant fingerprinting

- Video Watermarking
  - Real-time
  - Resist geometric attacks
  - Fulfill high-capacity watermark
Real-time Video Watermarking

- Improved Difference Energy Watermarking (IDEW) algorithm
- Difference Number Watermarking (DNW) algorithm
- Turbo-based DNW (T-DNW) algorithm
- Watermarking method based on extended m-sequences
High Capacity Watermark Embedding

- Energy Modulated Watermarking (EMW) algorithm
- Logarithmic scaling applied in EMW
- Multiple watermarking based on CDMA technique
Real-time Video Watermarking against Geometric Attacks

- New real-time video watermarking model
- Method based on self-recognition watermark pattern
Benchmarking for Video Watermarking Algorithms

- Video Benchmark (VBmark) v1.0
  - A visual benchmarking tool for video watermarking algorithms, which simulates the intentional or unintentional attacks for video data
Research Grants

- Jan.2009-Dec.2010, the Active Copyright Tracing and Surveillance System for Multimedia on Internet. (Supported by National 863 Hi-Tech Program)
- Jan.2006 – Dec.2007, Research on high-capacity and real-time watermarking for MPEG streams. (Supported by Natural Science Foundation of Hubei Province (NSF-HB))
- Jun.2004 – Jun.2006, Video monitoring and copyright protection system based on real-time digital watermarking (Supported by Innovation Fund for Technology Based Firms from Ministry of Science and Technology of China under)
Publications


Publications (Cont.)


Patents

- A Video Copyright Protection and Monitor System for Digital TV (ZL 200610018787.X)
- A Three Tier Framework Intelligent Image Steganalysis System (ZL200610018494.1)
- An active check authentication and monitor system for digital TV program (ZL200610018835.5)
- A Content-based robust image copy detection method (200810048164.6)
- A real-time video watermarking method against geometric attacks (200910060551.6)
- An digital content protection method and system towards terminal interface (200810048824.0)
Software Copyright

- Real-time Watermarking Software for MPEG-encoded Video Data (National computer software copyright certificate, 2004SR09077)
- Benchmarking System for Video Watermarking Algorithms. (National computer software copyright certificate, 2007SR09160)
- VPMark Video Watermarking System Software (National computer software copyright certificate, 2007SR09161)
- Image copy tracing system software on Internet (National computer software copyright certificate, 2008SR11023)
- Image Copy Detection System Software based on Linux Platform (National computer software copyright certificate, 2008SR11024)
- Digital Terminate Interface Protection System Software (National computer software copyright certificate, 2009SR10080)
Summary

- Resource sharing in peer-to-peer network
- Semantic search
- Link analysis & link mining
- Secure interoperability in distributed systems
- Watermarking & DRM
- Intelligent multimedia
Thank you!

http://idc.hust.edu.cn