Discover Viterbi: Cyber Security Engineering & Informatics Programs

Professor Cyrus Shahabi
Professor Clifford Neuman

Meghan Balding
Graduate & Professional Programs

November 11, 2015
Will I be able to get a copy of the slides after the presentation?  

YES!

How can I ask a question during the info session?

1. Use the Q&A panel to the right of this presentation.

2. Type your question in the box.

3. An USC representative will answer your question as soon as they are able.
## Today’s Program

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<th>Program</th>
<th>Overview</th>
<th>Criteria</th>
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</thead>
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<td>The University of Southern California</td>
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<tr>
<td>Viterbi School of Engineering</td>
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<tr>
<td>Master of Science in Data Informatics</td>
<td>Program Overview</td>
<td>Application Criteria</td>
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<tr>
<td>Master of Science in Cyber Security Engineering</td>
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<td>Application Criteria</td>
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<td>Tuition &amp; Fees</td>
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<td>Q&amp;A</td>
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</tbody>
</table>
University of Southern California

- Oldest private university in western U.S. – founded in 1880
- 43,000 Students: 19,000 Undergrads | 24,000 Graduates
- 3,900+ full-time faculty
- Diverse student population
Principal world center for aerospace, communications, biotech R&D, commerce, entertainment and the arts

Los Angeles provides a setting for numerous cultural, educational and career opportunities

California offers rich opportunities for internships and careers, with Silicon Valley to the north; the hub of biotech activity in San Diego, to the south; and Silicon Beach to the west - right in our back yard
**Viterbi School at a Glance**

- **8 Academic Departments**
- **Faculty**
  - 180 tenure-track faculty
  - 22 NAE
  - 60+ NSF CAREER, Nat’l & Presidential Young Investigator
- **Student population**
  - 2,600 Undergraduate
  - 5,200 Graduate students
- **Alumni**
  - More than 60,000+
- **Research**
  - Leader in funded research 45+ Research Centers
## Recent Announcements

- **Top Ranked** Graduate Engineering Program

**Best Online Graduate Engineering Programs** *by U.S. News & World Report (2015 Edition)*  
- **Ranked #1** in Online Computer Information Technology Program (Computer Science)  
- **Top 3 Ranked** Online Graduate Engineering Program

**Best Online Graduate Engineering Programs for Veterans** *by U.S. News & World Report (2015 Edition)*  
- **Ranked #1** Online Computer Information Technology for Veterans  
- **Ranked #2** Online Graduate Engineering for Veterans
# Viterbi School: Points of Distinction

<table>
<thead>
<tr>
<th>Points of Distinction</th>
</tr>
</thead>
<tbody>
<tr>
<td>• International Reputation for Excellence</td>
</tr>
<tr>
<td>• World Class Faculty &amp; Research</td>
</tr>
<tr>
<td>• NSF Career Awardees</td>
</tr>
<tr>
<td>• Sol Golomb, Nat’l Medal of Science</td>
</tr>
<tr>
<td>• MIT TR35 Faculty Distinctions</td>
</tr>
<tr>
<td>• Trojan Family Network</td>
</tr>
<tr>
<td>• Complete range of programs</td>
</tr>
<tr>
<td>• Ph.D., Master’s &amp; Bachelor’s Programs</td>
</tr>
<tr>
<td>• Graduate Certificates</td>
</tr>
<tr>
<td>• Continuing Education Short Courses</td>
</tr>
<tr>
<td>• Custom Programs</td>
</tr>
</tbody>
</table>
The Viterbi School of Engineering: A Leader In Research

Viterbi School is a consistent leader in funded research in the U.S.

- highly interdisciplinary research environment
- diverse research areas as robotics, software engineering, sensor networks, vision sciences, automated construction and photonics
- over 45 research centers
- industrial partnerships and collaboration

Institute for Creative Technologies
Biomimetic Microelectronic Systems Engineering Research Center
National Center for Metropolitan Transportation Research
CREATE Homeland Security Center
Meet Prof. Cyrus Shahabi and Prof. Clifford Neuman

Prof. Cyrus Shahabi

Professor of Computer Science and Electrical Engineering at USC
Director of the Informatics Program
Director of Integrated Media Systems Center (IMSC)
Ph.D. in Computer Science

Prof. Clifford Neuman

Research Associate Professor, Department of Computer Science
Director, USC Center for Computer Systems Security located at the Information Sciences Institute (USC-ISI)
Ph.D. in Computer Science
M.S. in Data Informatics

Delivery Options:
- On-campus only
Why Data Informatics?

Big Analytics – Small Files!

Machine Learning, Data Mining, etc.

Big Data – Small Analytics

Parallel DBs, Cloud, HPC, Distributed Sys, etc.
Why Data Informatics?

Application: Health, Transportation, Energy, etc.

Machine Learning, Data Mining, etc.

Parallel DBs, Cloud, HPC, Distributed Sys, etc.
Master of Science in Data Informatics provides students with the knowledge and skill to:

Understand and use **large data** environments
  - Hadoop, HDFS, Spark, etc.

Work with and use the various **analysis** tools
  - Machine learning
  - Data mining
  - Visualization
  - Etc...

Apply these methods to **real-world problems**
Big Data and Its Technical Challenges

In a broad range of application areas, data is being collected at an unprecedented scale. Decisions that previously were based on guesswork, or on painstakingly handcrafted models of reality, can now be made using data-driven mathematical models. Such Big Data analysis now drives nearly every aspect of society, including mobile services, retail, manufacturing, financial services, life sciences, and physical sciences.

As an example, consider scientific research, which has been revolutionized by Big Data. The Sloan Digital Sky Survey has transformed astronomy from a field where taking pictures of the sky was a large part of an astronomer's job to one where the pictures are already in a database, and the astronomer's task is to find interesting objects and phenomena using the database. In the biological sciences, there is now a well-established tradition of depositing scientific data into a public repository, and also of creating public

– Carl Kesselman (ISE)
  • Data management on Cloud
  • INF 551

– Wensheng Wu (Informatics)
  • Data Analytics
  • INF 551, 553

– Seon Ho Kim (IMSC)
  • End-to-end systems
  • INF 550
Data Informatics Team

• Liyue Fan (IMSC)
  – Machine Learning
  – INF 552

• Stefan Scherer (ICT)
  – Machine Learning
  – INF 552

• Luciano Nocera (IMSC)
  – Data Visualization
  – INF 554

• Yao-Yi Chiang (Spatial Sciences)
  – Data Mining
  – INF 553

• Yolanda Gil (ISI)
  – Intro to Data Science
  – INF 549

• Jaime Levy
  – User Experience
  – INF 556
## Required Courses (15 Units)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>INF 550</td>
<td>Overview of Data Informatics in Large Data Environments</td>
</tr>
<tr>
<td>INF 551</td>
<td>Foundations of Data Management</td>
</tr>
<tr>
<td>INF 552</td>
<td>Machine Learning for Data Informatics</td>
</tr>
<tr>
<td>INF 553</td>
<td>Foundations and Applications of Data Mining</td>
</tr>
<tr>
<td>INF 554</td>
<td>Information Visualization</td>
</tr>
<tr>
<td></td>
<td>OR</td>
</tr>
<tr>
<td>INF 555</td>
<td>User Interface Design, Implementation, and Testing</td>
</tr>
</tbody>
</table>
## M.S. in Data Informatics – Program Details

### Required Electives (12-14 units/choose 4 courses)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>INF520</td>
<td>Foundations of Information Security</td>
</tr>
<tr>
<td>INF528</td>
<td>Medical Diagnostics, Therapeutics and Informatics Applications</td>
</tr>
<tr>
<td>INF529</td>
<td>Engineering Data Analytics</td>
</tr>
<tr>
<td>INF549</td>
<td>Introduction to Computational Thinking and Data Science</td>
</tr>
<tr>
<td>INF556</td>
<td>User Experience Design and Strategy</td>
</tr>
<tr>
<td>INF557</td>
<td>Foresight for Engineers</td>
</tr>
<tr>
<td>INF560</td>
<td>Data Informatics Professional Practicum</td>
</tr>
<tr>
<td>INF562</td>
<td>Integration of Medical Imaging Systems</td>
</tr>
<tr>
<td>INF590</td>
<td>Directed Research</td>
</tr>
<tr>
<td>INF670</td>
<td>Data Sensing, Analysis and Instrumentation for Infrastructure</td>
</tr>
<tr>
<td>CSCI 544</td>
<td>Applied Natural Language Processing</td>
</tr>
<tr>
<td>CSCI 548</td>
<td>Information Integration on the Web</td>
</tr>
<tr>
<td>CSCI 561</td>
<td>Foundations of Artificial Intelligence</td>
</tr>
<tr>
<td>CSCI 570</td>
<td>Analysis of Algorithms</td>
</tr>
<tr>
<td>CSCI 572</td>
<td>Information Retrieval and Web Search Engines</td>
</tr>
<tr>
<td>CSCI 585</td>
<td>Database Systems</td>
</tr>
<tr>
<td>CSCI 587</td>
<td>Geospatial Information Management</td>
</tr>
<tr>
<td>CSCI-686</td>
<td>Advanced Big Data Analytics</td>
</tr>
</tbody>
</table>
What to Take

Sample Student Course Plan

First Semester
- INF-550 Overview of Data Informatics in Large Data Environments
- INF-551 Foundations of Data Management
- An elective from either Informatics or Computer Science

Second Semester
- INF-552 Machine Learning for Data Informatics
- INF-553 Foundations and Applications of Data Mining
- An elective from either Informatics or Computer Science

Third Semester
- Either
  - INF-554 Information Visualization
  - INF-555 User Interface Design, Implementation, and Testing
- INF-560 Data Informatics Professional Practicum
- An elective from either Informatics or Computer Science

NOTE: This is just a sample course plan!
Research Opportunities in Data Informatics

More than 10 faculty members at Viterbi School of Engineering working in the area of BigData, see: http://bdst.usc.edu

• Major VSoE research centers focusing on BigData:
  – Integrated Media Systems Center http://imsc.usc.edu
  – Information Sciences Institute http://isi.edu
M.S. in Cyber Security Engineering

Delivery Options:
- On-campus
- Online via DEN@Viterbi
Cyber Security Engineering focuses on fundamental theory and practice for engineering and operating secure information systems. The program addresses challenges of policy formulation, verifiably secure operating system components, security-aware applications, and use of cryptography and key management in high assurance environments and highly distributed cloud and network based applications.
Why pursue this degree?

Students should pursue this degree to prepare for careers as:

- Security software developers
- System Architects
- Security administrators
- Network administrators
- Forensic Investigators
- CISO’s (Chief Information Security Officers)
M.S. in Cyber Security Engineering - Differentiators

• The Curriculum for USC Viterbi's MS in Cyber Security Engineering is based on a solid foundation developed by practitioners and visionaries from the high assurance systems community.

• This foundation is used to explain the approaches and philosophy needed to secure the deployment of modern, always connected, systems and critical infrastructure.
Cyber Informatics Team

- Dr. Clifford Neuman (ISI/CS/Inf)
  - Security Architecture, Cyber-Physical Systems
  - CSCi530, INF527, INF529

- Dr. Lotfi ben Othmane (Inf)
  - Secure Software
  - INF 525, INF 521

- Joseph Greenfield (ITP/Inf)
  - Forensics
  - INF 528

- Dr. Tatyana Ryutov (ISI)
  - Policy
  - INF 523

- David Morgan (ITP)
  - Security Foundations
  -INF 520
More than 15 faculty members at Viterbi School of Engineering working in the area of computer security, see: http://ccss.usc.edu

• Major VSoE research capabilities in security:
  – DHS Funded DETER Lab http://deter-project.org
  – Information Sciences Institute http://isi.edu
# M.S. in Cyber Security Engineering – Program Details

<table>
<thead>
<tr>
<th>Required Courses (22 Units of 27 units total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>INF 520</td>
</tr>
<tr>
<td>INF 521</td>
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<td>INF 522</td>
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<td>INF 523</td>
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<tr>
<td>INF 525</td>
</tr>
<tr>
<td>CSci530</td>
</tr>
<tr>
<td>INF 527</td>
</tr>
</tbody>
</table>
## M.S. in Cyber Security Engineering – Program Details

### Electives (to bring total units to 27)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>INF 528</td>
<td>Computer and Network Forensics</td>
<td>3 units</td>
</tr>
<tr>
<td>INF 526</td>
<td>Secure Systems Administration</td>
<td>3 units</td>
</tr>
<tr>
<td>INF 590</td>
<td>Directed Research and/or Internship opportunities</td>
<td>1-3 units</td>
</tr>
<tr>
<td>PTE 519</td>
<td>Integrated Physical and Cyber Security for Oil and Gas</td>
<td>3 units</td>
</tr>
<tr>
<td>ISE 599</td>
<td>Security and Game Theory</td>
<td>3 units</td>
</tr>
<tr>
<td></td>
<td>Other classes upon approval by department</td>
<td></td>
</tr>
</tbody>
</table>
Where our Alumni are working

Where do our students go?
- Google, Microsoft, Symantec, defense contractors, the big IT consulting firms

What do our graduates do?
The typical admitted student will have the following qualifications:

- An undergraduate degree in computer science, electrical engineering or information security;
- Programming capability;
- Understanding the Theory of Computation and operating systems;
- Desire to learn information security techniques and tools that are directly applicable to current information security challenges; and
- Above average mathematical foundation

Additional criteria includes:

- To be competitive, a cumulative undergraduate GPA of at least 3.0 on a 4.0 scale is recommended
- Satisfactory scores on the general portion of the Graduate Record Examination (GRE) that are less than five years old
- Supplemental Materials:
  - Letters of Recommendation (Optional)
  - Statement of Purpose (Optional)

Please visit viterbi.usc.edu/msdegrees for complete requirements
Application Deadlines for M.S. Programs


- For residential students: Apply by December 15, 2015 to be considered for funding opportunities – including the Dean's Scholarship (https://gapp.usc.edu/graduate-programs/graduate-funding/masters/scholarships/viterbi-scholarships)

SPRING 2017 – September 15, 2016

Apply Online

- http://www.usc.edu/admission/graduate/apply
Course Delivery Methods

Methods of Course Delivery

- **On-campus, full time**
  - 3 classes per semester
  - 1.5-2 years to complete degree

- **Online delivery via DEN@Viterbi**
  - 1-2 classes per semester
  - 2 ½ - 3 years to complete degree
More than **40 years** of distance education expertise

Online delivery makes earning an MS degree practical and flexible for working professionals

**DEN@Viterbi students:**

- View the same lectures as on-campus students, with fresh content every semester
- Participate in highly interactive discussions with professors and peers
- Submit homework electronically
- Take exams at proctored testing centers near their home or work (or at USC if in the Los Angeles area)
<table>
<thead>
<tr>
<th>Distance Education Network (DEN@Viterbi)</th>
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</table>

<table>
<thead>
<tr>
<th></th>
<th>DEN@Viterbi Student</th>
<th>On-Campus Student</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program Admission</td>
<td>USC Graduate Application &amp; required materials</td>
<td>USC Graduate Application &amp; required materials</td>
</tr>
<tr>
<td>Weekly Course Lectures</td>
<td>Online with Interactivity</td>
<td>On USC’s Campus</td>
</tr>
<tr>
<td>Online Course Archives</td>
<td>✓</td>
<td>✓  *</td>
</tr>
<tr>
<td>(Lectures &amp; Course Documents)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assignments</td>
<td>Submit electronically via email or fax according to course deadlines</td>
<td>Submit during lecture or lab according to course deadlines</td>
</tr>
<tr>
<td>Exams</td>
<td>Proctored location</td>
<td>USC’s campus</td>
</tr>
<tr>
<td>Courses per Semester</td>
<td>1-2</td>
<td>3-4</td>
</tr>
<tr>
<td>(Average)</td>
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<td></td>
</tr>
<tr>
<td>Degree Completion</td>
<td>27-34 units with a 3.0 GPA or above</td>
<td>27-34 units with a 3.0 GPA or above</td>
</tr>
<tr>
<td>Requirements</td>
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<td></td>
</tr>
<tr>
<td>USC Diploma</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>(No Distinction)</td>
<td></td>
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</tr>
</tbody>
</table>

*DEN@Viterbi sections only.
Schematic of deflagration

Turbulent premixed flame experiment in a fan-stirred chamber (http://www.meche.leeds.ac.uk/res-group/combustion/activities/Bomb.htm)

Flame thickness $\delta \sim \alpha / S_L$

($\alpha$ = thermal diffusivity)

Direction of propagation
Speed relative to unburned gas = $S_L$

Reaction zone
Temperature
Reactant concentration

Convection-diffusion zone
$\delta = c_0 S_L = 0.3 \sim 6$ mm
DEN@Viterbi’s E-Learning System

DEN@Viterbi Classroom on USC’s Campus
Limited Status

- Allows strong candidates to begin coursework before formal admission.
- Courses *(maximum of 12 units)* can be applied toward degree program once admitted but *limited status does not guarantee admission*.
- Get Started: [http://gapp.usc.edu/graduate-programs/den/getting-started](http://gapp.usc.edu/graduate-programs/den/getting-started)
- If approved, contact masters@gapp.usc.edu for advisement on course registration.

Tuition Deferment Program

- Students supported by company can defer “up front” payment of tuition until after the semester is over.
- Company must pay 75-100% of tuition to be eligible for program.
- For additional information: [http://gapp.usc.edu/tuitiondeferment](http://gapp.usc.edu/tuitiondeferment)
Tuition & Fees for M.S. Students

PER-COURSE TUITION

<table>
<thead>
<tr>
<th>500/600 level course: $1,774 per unit</th>
<th>Tuition for 3-Unit Course</th>
<th>Tuition for 4-Unit Course</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$5,322</td>
<td>$7,096</td>
</tr>
</tbody>
</table>

- Degree Programs are 27-34 units (9-11 courses)

- For an overview of additional fees, please visit: [https://gapp.usc.edu/graduate-programs/graduate-funding/masters/tuition](https://gapp.usc.edu/graduate-programs/graduate-funding/masters/tuition)
Getting Started

For those interested in taking classes on campus:
- Visit USC campus
- Start your application: http://www.usc.edu/admission/graduate/apply

For those interested in DEN@Viterbi delivery
- Start as Limited Student next semester or apply for admission at the link above
USC Viterbi School of Engineering
Graduate and Professional Programs

Email (On Campus): viterbi.gradprograms@usc.edu
Email (DEN@Viterbi): DEN@Viterbi.usc.edu

Phone: 213.740.4488

Web: http://viterbi.usc.edu/msdegrees