Clusters
A Introduction
• Data Management   12:30
• Distributed Systems 12:40
• Computer Graphics and Visualizations 12:50
• Intelligent Systems 13:00
• Languages and Tools 13:10
• Security 13:20
• Theory 13:30
DATA MANAGEMENT
CAROL ROMANOWSKI
Overview

- CSCI 620 Introduction to Big Data
- CSCI 621 Database System Implementation
- CSCI 622 Secure Data Management
- CSCI 720 Big Data Analytics
- CSCI 721 Data Cleaning and Prep
- CSCI 729 Special Topics
- Note: 620, 720 and two electives chosen from the above or from specific CSCI and IST courses qualifies you for the Big Data Analytics certificate
- Areas of interest: Data storage and management, data-intensive computing, analytics, and security and privacy
Research interests

• Dr. Xumin Liu:
  – Large scale data management, integration, and analytics
  – Web service discovery, composition, and recommendation
  – Workflow mining and business process intelligence

• Dr. Rajendra Raj: Thesis students only
  – Security & privacy in large-scale data in cloud, mobile and distributed systems
  – Critical infrastructure protection and resilience
Research interests

• Dr. Carlos Rivero
  – Integrating and exchanging data in both the Deep Web and the Web of Data
  – Querying graph databases

• Dr. Carol Romanowski: Prefer thesis students
  – Big Data in critical infrastructure protection and resilience
  – Engineering design analytics

Find out more here: https://www.cs.rit.edu/~datalab/
DISTRIBUTED SYSTEMS CLUSTER
MINSEOK KWON
Introduction

• This area studies systems formed from multiple cooperating computers.
  – Distributed systems
  – Distributed middleware
  – Pervasive and mobile computing
  – Computer networking protocols
  – Network security
  – Cloud computing
  – Parallel computing on multicores, clusters, and GPUs
Distributed Systems in Industry

- Datacenters
  - Online retailers (Amazon), video (YouTube), social networking (Facebook), search (Google), clouds (Azure)
- Financial transaction systems
- Cloud computing
- Routers and switches
- Network protocols
- Network security
Faculty

- Mohan Kumar (department chair)
- Peizhao Hu
- Alan Kaminsky
- Hans-Peter Bischof (grad coordinator)
- Minseok Kwon (cluster head)

- For capstone projects, check out the wiki page!
Courses

• CSCI 651 Foundations of Computer Networks
• CSCI 652 Distributed Systems
• CSCI 654 Foundations of Parallel Computing
• CSCI 759 Pervasive and Mobile Systems
• CSCI 799 Computer Science Graduate Independent Study Distributed Systems Cluster
Research Projects

• Prof. Mohan Kumar’s research areas
  – Pervasive and mobile computing
  – Opportunistic computing

• Prof. Peizhao HU’s research areas
  – Mobile and pervasive computing
  – Context modeling and context-aware computing
  – Adaptive wireless mesh networks, opportunistic networks
  – Smart sensor systems and networks

• Prof. Kwon’s research areas
  – Computer networks
  – Distributed systems
  – Mobile and cloud computing
COMPUTER GRAPHICS AND VISUALIZATION
JOE GEIGEL
Computer Graphics and Visualization

- Areas for further study include Graphics Programming, Rendering and Image Synthesis, Applied Perception, Computer Animation and Virtual Reality, Image Processing and Analysis, and Data Visualization.
Faculty

• Prof Reynold Bailey
• Prof Hans-Peter Bischof
• Prof Warren Carithers
• Prof Joe Geigel
• Prof Sean Strout
• Prof Linwei Wang
Selected Research Areas

Eye Tracking & Gaze Manipulation
Virtual and Augmented Reality
Gestural Interfaces
Motion Capture
Applied Perception
Scientific Visualization

CS Graphics and Applied Perception Lab
http://www.cs.rit.edu/~graphics/lab -- GOL - 3600
Courses

• CSCI 610 – Foundations in Computer Graphics (Fall / Spring)
• CSCI 711 – Global Illumination (Spring)
• CSCI 712 – Computer Animation: Algorithm + Techniques (Fall – odd years)
• CSCI 713 – Applied Perception in Graphics (Fall)
• CSCI 714 – Scientific Visualization (Spring)
• CSCI 715 – Applications in VR (Fall – even years)
• CSCI 716 – Computational Geometry (Spring)
• CSCI 719 – Topics in Computer Graphics (as needed)
For more info

• Joe Geigel
• GOL-3527
• jmg@cs.rit.edu
INTELLIGENT SYSTEMS
ZACK BUTLER
What we do

Faculty and students in the Intelligent Systems Area work with the theories, algorithms and hardware needed to create systems that are able to perceive the world and act intelligently.
Who we are

• Zack Butler
• Roxanne Canosa
• Roger Gaborski
• Leon Reznik
• Linwei Wang
• Richard Zanibbi
Research areas

• Robotics
• Computer Vision, Image Understanding
• Machine Learning
  – Several different applications: security, biomedicine, everything else on this list
• Document recognition & retrieval
• http://www.cs.rit.edu/~isystems
Languages and Tools Cluster

The Languages and Tools cluster studies language design and implementation together with architecture and use of software development tools. Students specializing in this cluster can gain a broad understanding of theoretical and applied knowledge.
Languages and Tools Cluster

• Programming languages are the communication medium for computation.
• They help us express computations
  — precisely, in ways that we can reason about them
  — while still keeping things at a high level.
• Our languages influence our way of thinking about computation.
• It is one of the fundamental areas that support all application areas.
Languages and Tools Cluster: SampleTopics

- Programming styles and paradigms (imperative, functional, object-oriented, logic, aspect-oriented, actor-oriented, . . . )
- Programming-language design (what the human reads/writes)
- Programming-language implementation (what the machine executes)
- Domain-specific languages (custom PLs)
- Software-development tools (programmer productivity)
Languages and Tools Cluster

• Areas of study range from
  – theoretical foundations
    • formal mathematical descriptions of language semantics
  – through system-level concerns
    • e.g., efficient compiler design
  – to practical considerations
    • e.g. usability by software engineers
Languages and Tools Cluster: Courses

- CSCI-641: Advanced Programming Skills
  - Aspect-Oriented Programming
  - Functional Programming and Haskell
  - Design Patterns and C#/.Net
  - Advanced C++
  - ...
- CSCI-740: Programming Language Theory
- CSCI-742: Compiler Construction
- (CSCI-743: Software Development Tools)
- CSCI-749: Topics in Languages and Tools (Seminar)
Languages and Tools Cluster: Faculty

• Prof. Hans-Peter Bischof
• Prof. Fereydoun Kazemian
• Prof. Arthur Nunes-Harwitt
• Prof. Rajendra Raj
• Prof. James Heliotis
• Prof. Matthew Fluet
Languages and Tools Cluster: Faculty

• **Prof. Hans-Peter Bischof**
  - http://www.cs.rit.edu/~hpb; hpb@cs.rit.edu
  - **Research Area and Interests:**
    - Visualization
    - languages

• **Prof. Fereydoun Kazemian**
  - http://www.cs.rit.edu/~fxk; fxk@cs.rit.edu
  - **Research Area and Interests:**
    - software engineering
    - user interfaces
    - functional programming
Languages and Tools Cluster: Faculty

Prof. Arthur Nunes-Harwitt

– http://www.cs.rit.edu/~anh ; anh@cs.rit.edu
– Research Area and Interests:
  • programming languages
  • computer algebra

Prof. Rajendra Raj

– http://www.cs.rit.edu/~rkr ; rkr@cs.rit.edu
– Research Area and Interests:
  • critical infrastructure protection
  • software design, architecture and reuse
Languages and Tools Cluster: Faculty

Prof. James Heliotis

– [http://www.cs.rit.edu/~jeh](http://www.cs.rit.edu/~jeh); jeh@cs.rit.edu

– Research Area and Interests:
  - software development tools, tool modeling
  - programmer productivity
  - programming languages and CS education
Languages and Tools Cluster: Faculty

Prof. Matthew Fluet
– http://www.cs.rit.edu/~mtf; mtf@cs.rit.edu

Research Area and Interests:
• functional programming
• compiler construction
• parallelism and concurrency
• program analysis
type systems

Research Goals:
Make it easy to write programs that run fast and are guaranteed to be safe.

Research Projects:
• Manticore: an effort to design and implement a parallel functional PL
• MLton: a whole-program optimizing Standard ML compiler
Type- and Control-Flow Analysis: a program analysis refined by types
Transactional Events: a novel concurrency abstraction
SECURITY
HANS-PETER BISCHOF
Security: Faculty

- Prof. Hans-Peter Bischof
- Prof. Chris Homan
- Prof. Peizhou Hu
- Prof. Alan Kaminsky
- Prof. James Minseok Kwon
- Prof. Stanislaw P. Radziszowski
- Prof. Rajendra K. Raj
- Prof. Leon Reznik
- Prof. Warren R. Carithers
Security: Courses

- CSCI 622  Secure Data Management
- CSCI 642  Secure Coding
- CSCI 651  Foundations of Computer Networks (required)
- CSCI 662  Foundations of Cryptography
- CSCI 729  Topics in Data Management
- CSCI 734  Foundations of Security Measur. and Evaluation
- CSCI 735  Foundations of Intelligent Security Systems
- CSCI 739  Topics in Intelligent Systems
- CSCI 759  Topics in Systems
- CSCI 762  Advanced Cryptography
- CSCI 769  Topics in Theory
THEORY
IVONA BEZÁKOVA
Cluster: Theory

Faculty:

Edith Hemaspaandra (eh@cs.rit.edu)
(computational social choice, computational complexity, complexity of logics)

Ivona Bezáková (ib@cs.rit.edu)
(algorithms, usually counting/sampling, graph theory)

Chris Homan (cmh@cs.rit.edu)
(computational social network analysis, sampling in hard-to-reach online communities)

Stanisław Radziszowski (spr@cs.rit.edu)
(combinatorial computing, Ramsey theory, extremal graph theory)
Cluster: Theory

Edith Hemaspaandra
- computational social choice
- computational complexity
- complexity of logics
Cluster: Theory

Chris Homan

- computational social network analysis
  - combines social media, network science, sociology, and advanced computational methods to study social networks
  - sampling in hard-to-reach online communities
Stanisław Radziszowski
- combinatorial computing
  - Ramsey theory
  - extremal graph theory

R(3,3) = 6
(5 nodes, no red or blue triangle)
Cluster: Theory

Ivona Bezáková
- algorithms
  - counting/sampling
  - graph algorithms
  - Markov chains

http://www.sciencephoto.com/media/310285/view
Cluster: Theory

Ivona Bezáková

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  - counting/sampling
  - graph algorithms
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