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14. ABSTRACT

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RPPR Final Report
as of 31-Jan-2018

Agency Code:

Proposal Number: 64096CSCF

Agreement Number: W911NF-13-1-0372

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Report Date: 31-Mar-2017

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Final Report for Period Beginning 01-Jan-2014 and Ending 31-Dec-2016

Title: Triangle Computer Science Distinguished Lecture Series

Begin Performance Period: 01-Jan-2014

End Performance Period: 31-Dec-2017

Report Term: 0-Other

Submitted By: Carlo Tomasi

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Distribution Statement: 1-Approved for public release; distribution is unlimited.

STEM Degrees:

STEM Participants:

Major Goals: The major goal of this project is to run a series of lectures by distinguished speakers in computer science. The lectures are hosted at Duke University (Duke), the University of North Carolina at Chapel Hill (UNC), and North Carolina State University (NCSU).

Accomplishments: The talks listed in the accompanying PDF document were given.

Training Opportunities: All seminars were widely attended by PhD students at the three institutions. Many of the talks were attended by undergraduates as well. These seminars presented a very significant opportunity for all to be exposed to the best research in computer science.

Results Dissemination: Seminars were also broadcast to other local universities on demand.

Honors and Awards: Nothing to Report

Protocol Activity Status:

Technology Transfer: Nothing to Report

PARTICIPANTS:

Participant Type: PD/PI

Participant: Carlo Tomasi

Person Months Worked: 1.00

Funding Support:

Project Contribution:

International Collaboration:

International Travel:

National Academy Member: N

Other Collaborators:

Participant Type: Faculty

Participant: Franc Brglez

Person Months Worked: 1.00

Funding Support:

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as of 31-Jan-2018

Project Contribution:
International Collaboration:
International Travel:
National Academy Member: N
Other Collaborators:

Participant Type: Faculty
Participant: Anselmo Lastra
Person Months Worked: 1.00
Project Contribution:
International Collaboration:
International Travel:
National Academy Member: N
Other Collaborators:

Funding Support:

Participant Type: Faculty
Participant: Mladen Vouk
Person Months Worked: 1.00
Project Contribution:
International Collaboration:
International Travel:
National Academy Member: N
Other Collaborators:

Funding Support:

Participant Type: Faculty
Participant: Carlos Benavente
Person Months Worked: 1.00
Project Contribution:
International Collaboration:
International Travel:
National Academy Member: N
Other Collaborators:

Funding Support:

Participant Type: Faculty
Participant: Jasleen Kaur
Person Months Worked: 1.00
Project Contribution:
International Collaboration:
International Travel:
National Academy Member: N
Other Collaborators:

Funding Support:

WEBSITES:

RPPR Final Report
as of 31-Jan-2018

URL: <http://cs.unc.edu/tcsdls/>

Date Received: 30-Jan-2018

Title: TCSDLS Schedule of Talks

Description: This site is a complete repository of TCSDLS talks

Learning about Agents and Mechanisms from Opaque Transactions

Avrim Blum, Toyota Technological Institute at Chicago

(telecast from Duke)

Monday, January 29, 2018

In this talk I will discuss the problem of trying to learn the requirements and preferences of economic agents by observing the outcomes of an allocation mechanism whose rules you also don't initially know. As an example, consider observing web pages where the agents are advertisers and the winners are those whose ads show up on the given page. We know these ads are placed based on bids and other constraints given to some auction mechanism, but we do not get to see these bids and constraints.

Humans, Machines, and Work: The Future is Now

Moshe Vardi, Rice University

(telecast from Duke)

Monday, January 22, 2018

Automation, driven by technological progress, has been increasing inexorably for the past several decades. Two schools of economic thinking have for many years been engaged in a debate about the potential effects of automation on jobs: will new technology spawn mass unemployment, as the robots take jobs away from humans? Or will the jobs robots take over create demand for new human jobs?

Broadening Participation in Computing

Maria Klawe, Harvey Mudd College

(telecast from NCSU)

Monday, November 20, 2017

Computing is one of the least diverse disciplines in science and engineering in terms of participation by women, African-Americans and Hispanics, and the only discipline where participation by women has significantly decreased over the last three decades. While our discipline does well in encouraging members of underrepresented groups to go on to graduate programs, we have been less successful in attracting members of these groups into undergraduate programs.

Machine Learning for Policy Evaluation: Prediction, Causal Inference, and Personalization

Susan Athey, Stanford

(telecast from Duke)

Monday, March 20, 2017

With the advent of wide access to "big data" machine learning has made enormous advances in supervised and unsupervised techniques. Standard supervised ML focuses on prediction problems, but many real-world policy problems can only be partially addressed using purely predictive techniques. A recent literature has emerged combining techniques from machine learning with tools from the literatures on program evaluation and causal inference.

A Computer Scientist Thinks About the Brain

Christos Papadimitriou, University of California, Berkeley

(telecast from Duke)

Monday, March 06, 2017

When key problems in science are revisited from the computational viewpoint, occasionally unexpected progress results. There is a reason for this: Implicit algorithmic processes are present in the great objects of scientific inquiry - the cell, the brain, the market - as well as in the models developed by scientists over the centuries for studying them.

Human Decisions and Machine Predictions

Jon Kleinberg, Cornell University

(telecast from Duke)

Monday, February 20, 2017

An increasing number of domains are providing us with detailed trace data on human decisions, often made by experts with deep experience in the subject matter. This offers an opportunity to use machine-learning prediction algorithms to ask several families of questions --- not only about the extent to which algorithms can outperform expert-level human decision-making in specific domains, but also whether we can use algorithms to analyze the nature of the errors made by human experts, to predict which instances will be hardest for these experts, and to explore some of the ways in which prediction algorithms can serve as supplements to human decision-making in different applications.

Natural Language is a Programming Language

Michael Ernst, University of Washington

(telecast from NCSU)

Monday, January 23, 2017

A program is commonly thought of as source code: a sequence of instructions that achieve some particular task. Source code is amenable to formal mathematical analysis, such as abstract interpretation and model checking to indicate whether the program satisfies a formal specification. This is a limited way to view a program. Software developers also make use of test cases, executions, documentation, variable names, the program structure, version control repositories, issue trackers, and more.

Computing Personal Lifestyle for Building Health Models

Ramesh Jain, University of California, Irvine

(telecast from NCSU)

Monday, December 05, 2016

A person's lifestyle is the most controllable factor affecting her health. Advances in technology have made it now possible to analyze and understand an individual's life style from passively collected objective data streams to build her model and predict important events in her life. Wearable/mobile sensors, smart homes, social networks, e-mail, calendar systems, and environmental sensors continuously generate data streams that can be used as lifestyle data. By assimilating and aggregating these multi-sensory data streams, we create an accurate chronicle of a person's life.

An Expanding and Expansive View of Computing

Jim Kurose, National Science Foundation

(telecast from UNC)

Monday, November 14, 2016

Advances in computer and information science and engineering are providing unprecedented opportunities for research and education. My talk will begin with an overview of CISE activities and programs at the National Science Foundation and include a discussion of current trends that are shaping the future of our discipline. I will also discuss the opportunities as well as the challenges that lay ahead for our community and for CISE.

Generating Natural-Language Video Descriptions using LSTM Recurrent Neural Networks

Raymond Mooney, University of Texas at Austin

(telecast from UNC)

Monday, October 17, 2016

We present a method for automatically generating English sentences describing short videos using deep neural networks. Specifically, we apply convolutional and Long Short-Term Memory (LSTM) recurrent networks to translate videos to English descriptions using an encoder/decoder framework. A sequence of image frames (represented using deep visual features) is first mapped to a vector encoding the full video, and then this encoding is mapped to a sequence of words.

The Algorithm as a Scientific World View

Christos Papadimitriou, University of California, Berkeley

(telecast from NCSU)

Sunday, March 06, 2016

When key problems in science are revisited from the computational viewpoint, occasionally unexpected progress results. There is a reason for this: Implicit algorithmic processes are present in the great objects of scientific inquiry - the cell, the brain, the market - as well as in the models developed by scientists over the centuries for studying them. This unexpected power of computational ideas, sometimes called "the algorithmic lens", has manifested itself in these past few decades in virtually all sciences: natural, life, or social for example, in statistical physics through the study of phase transitions in terms of the convergence of Markov chain-Monte Carlo algorithms, and in quantum mechanics through quantum computing. This talk will focus on three other instances. Almost a decade ago, ideas and methodologies from computational complexity revealed a subtle conceptual flaw in the solution concept of Nash equilibrium, which lies at the foundations of modern economic thought. In the study of evolution, a new understanding of century-old questions has been achieved through surprisingly algorithmic ideas. Finally, current work in theoretical neuroscience suggests that the algorithmic point of view may be useful in the central scientific question of our era, namely understanding how behavior and cognition emerge from the structure and activity of neurons and synapses.

Artificial Intelligence and Real Economics

Michael Wellman, University of Michigan

(telecast from NCSU)

Monday, February 29, 2016

The field of artificial intelligence is enjoying renewed attention today, based on its pervasive influence on a wide range of technologies, and promise for transformative effects in the near-term future. Coincident with the economic impact of AI in this century has been an increasing embrace of economic reasoning in the design and analysis of AI systems.

Making Robots Learn

Pieter Abbeel, University of California, Berkeley

(telecast from Duke)

Monday, February 22, 2016

Programming robots remains notoriously difficult. Equipping robots with the ability to learn would by-pass the need for what often ends up being time-consuming, task-specific programming. In this talk I will describe the ideas behind two promising types of robot learning: First I will discuss apprenticeship learning, in which robots learn from human demonstrations, and which has enabled autonomous helicopter aerobatics, knot tying, basic suturing, and cloth manipulation.

Legion: Programming Heterogeneous, Distributed Parallel Machines

Alex Aiken, Stanford University

(telecast from NCSU)

Monday, February 01, 2016

Programmers tend to think of parallel programming as a problem of dividing up computation, but often the most difficult part is the placement and movement of data, especially in heterogeneous, distributed machines with deep memory hierarchies. Legion is a programming model and runtime system for describing hierarchical organizations of both data and computation at an abstract level. A separate mapping interface allows programmers to control how data and computation are placed onto the actual memories and processors of a specific machine.

Probabilistic Inference on Strings

Jason Eisner, Johns Hopkins University

(telecast from UNC)

Monday, November 30, 2015

Natural language processing must sometimes consider the internal structure of words, e.g., in order to understand or generate an unfamiliar word. Unfamiliar words are systematically related to familiar ones due to linguistic processes such as morphology, phonology, abbreviation, copying error, and historical change.

Large-Scale Neuromorphic Systems

Rajit Manohar, Cornell University

(telecast from UNC)

Monday, November 16, 2015

VLSI scaling has led to the advent of massively parallel computing architectures as a way to circumvent the limitations of conventional approaches to improving performance and power. This can be seen in the architecture of general-purpose processors and in the advent of general-purpose graphics processing units. Standard architectures face algorithmic limitations to parallelism that limits scaling. Neuromorphic computing provides a promising alternative as a natively parallel computing paradigm for implementing real-time processing for vision and speech.

Aerial Robot Swarms

Vijay Kumar, University of Pennsylvania

(telecast from UNC)

Monday, October 19, 2015

Autonomous micro aerial robots can operate in three-dimensional, indoor and outdoor environments, and have applications to search and rescue, first response and precision farming. Dr. Kumar will describe the challenges in developing small, agile robots and the algorithmic challenges in the areas of (a) control and planning, (b) state estimation and mapping, and (c) coordinating large teams of robots.

Deferring Transactions for Fun and Profit

Johannes Gehrke, Cornell University

(telecast from Duke)

Monday, September 28, 2015

Transactions have for decades provided the gold standard for writing data-driven applications. I will describe two scenarios where we want transactions, but where we can seemingly not really achieve them. In our first model, we want to make joint travel arrangements or jointly enroll in classes, i.e., two or more people want to cooperate to select a seat or a class. But a transaction gives the illusion of having the database by itself, preventing information flow. We show how to slightly change transactions to enable efficient cooperation.

Automating Abstract Interpretation

Thomas Reps, University of Wisconsin

(telecast from Duke)

Monday, April 06, 2015

Unfortunately, the problem of determining whether a program is correct is undecidable. Program-analysis and verification tools sidestep the tar-pit of undecidability by working on an abstraction of a program, which over-approximates the behavior of the original program. The theory underlying this approach is called abstract interpretation. Abstract interpretation provides a way to obtain information about the possible states that a program reaches during execution, but without actually running the program on specific inputs.

Fast and accurate physical modeling in complex geometry

Leslie Greengard, Courant Institute

(telecast from Duke)

Monday, March 30, 2015

During the last few decades, fast algorithms have brought a variety of large-scale modeling tasks within practical reach. This is particularly true of integral equation approaches to electromagnetics, acoustics, gravitation, elasticity, and fluid dynamics. The practical application of these methods, however, requires analytic representations that lead to well-conditioned linear systems, techniques for error estimation that permit robust mesh refinement, and implementations on high-performance computing platforms.

Kicking and Fixing Software

Neeraj Suri, Technische Universitaet Darmstadt

(telecast from NCSU)

Monday, March 16, 2015

The perpetual elusiveness of correct-by-design software fosters the need of techniques to "find and fix" software deficiencies whether they arise from design, operational or deliberate instances. With the intent of post-design software fixes, the talk ruminates on the fun, value and science of experimental techniques to "kick n' fix" software.

Dancing with the Adversary: A Tale of Wimps and Giants

Virgil Gligor, Carnegie Mellon University

(telecast from Duke)

Monday, February 16, 2015

A system without accurate and complete adversary definition cannot possibly be insecure. Without such definitions, (in)security cannot be measured, risks of use cannot be accurately quantified, and recovery from penetration events cannot have lasting value. Conversely, accurate and complete definitions can help deny the adversary any attack advantage over a system defender and, at least in principle, secure system operation can be achieved.

Massive-Scale Streaming Analytics

David Bader, Georgia Institute of Technology

(telecast from Duke)

Monday, February 02, 2015

Emerging real-world graph problems include: detecting community structure in large social networks; improving the resilience of the electric power grid; and detecting and preventing disease in human populations. Unlike traditional applications in computational science and engineering, solving these problems at scale often raises new challenges because of the sparsity and lack of locality in the data, the need for additional research on scalable algorithms and development of frameworks for solving these problems on high performance computers, and the need for improved models that also capture the noise and bias inherent in the torrential data streams. In this talk, the speaker will discuss the opportunities and challenges in massive data-intensive computing for applications in computational science and engineering.

The World of Tiny Motions

William T. Freeman, Massachusetts Institute of Technology

(telecast from Duke)

Monday, January 12, 2015

We have developed a "motion microscope" to visualize small motions by synthesizing a video with the desired motions amplified. The project began as an algorithm to amplify small color changes in videos, allowing color changes from blood flow to be visualized. Modifications to this algorithm allow small motions to be amplified in a video. I'll describe the algorithms, and show color-magnified videos of adults and babies, and motion-magnified videos of throats, pipes, cars, smoke, and pregnant bellies.

The Fusion of Supercomputing and Big Data Analytics to Drive Scientific Discovery

Peter J. Ungaro, Cray, Inc.

(telecast from UNC)

Monday, April 14, 2014

Supercomputing is about getting the highest performance and most realistic simulations possible on basketball court-sized tightly integrated systems for scalability and usability. Large Scale data analytics is about getting knowledge out of immense amounts of data on warehouse-sized, low-cost commodity and cloud-based systems. In this talk, we will look at if the technologies and systems used to solve these problems are diverging or converging over time and how changes in system architecture and a more holistic approach can change the game for scientific discovery in the future.

The Cryptographic Lens

Shafi Goldwasser, Massachusetts Institute of Technology

(telecast from Duke)

Tuesday, April 01, 2014

Going beyond the basic challenge of private communication, over the last 35 years cryptography has become the general study of correctness and privacy of computation in the presence of a computationally bounded adversary, and as such it has changed how we think about proofs, reductions, randomness, secrets, and information. In this talk I will discuss some beautiful developments in the theory of computing through this cryptographic lens, and the role cryptography can play in the next successful shift from local to global computation.

Geometric Representations of Graphs

Laszlo Lovasz, Eotvos Lorand University

(telecast from Duke)

Monday, March 03, 2014

To represent a graph by a nice geometric picture is a natural goal in itself, but in addition it is an important tool in the study of various graph properties and in the design of graph algorithms. We survey several forms of this interplay between graph algorithms and geometry: algorithms for perfect graphs, maximum cut, connectivity, bandwidth. We discuss how to use a representation obtained from the adjacency matrix to compute an almost optimal weak regularity partition in constant time in the property testing model.

Algorithms Meet Art, Puzzles, and Magic

*Erik Demaine, Massachusetts Institute of Technology
(telecast from NCSU)*

Monday, February 17, 2014

When I was six years old, my father Martin Demaine and I designed and made puzzles as the Erik and Dad Puzzle Company, which distributed to toy stores across Canada. So began our journey into the interactions between algorithms and the arts (here, puzzle design). More and more, we find that our mathematical research and artistic projects converge, with the artistic side inspiring the mathematical side and vice versa. Mathematics itself is an art form, and through other media such as sculpture, puzzles, and magic, the beauty of mathematics can be brought to a wider audience.

Big Data and Dynamic Applications

*Craig C. Douglas, University of Wyoming
(telecast from NCSU)*

Monday, February 10, 2014

Dynamic Applications is a paradigm whereby applications and measurements become a symbiotic feedback control system with the ability to dynamically incorporate additional data into an executing application and to dynamically steer the measurement process, which provides more accurate analysis and prediction, more precise controls, and more reliable outcomes. Big Data is a paradigm for methods to handle nearly infinite amounts of data that is either streamed or is historically stored in (potentially ever growing) datasets for data mining.

Quality of Information-Aware Networking

*Tom La Porta, Pennsylvania State University
(telecast from NCSU)*

Monday, February 03, 2014

In this talk I introduce the concept of QoI-Aware networking. Most communication network theories, designs and control algorithms address performance metrics such as throughput, delay or errors, in terms of data bits. We postulate that communication networks should be viewed as information sources, and thus should be evaluated and controlled in terms of the quality of information they convey. We consider information metrics such as completeness, accuracy, precision and timeliness. Many of these metrics must be specified in the context in which the information is being used.

Cyber-Physical Systems: A Fundamental Intellectual Challenge

Edward Lee, University of California, Berkeley

(telecast from UNC)

Monday, January 27, 2014

The term cyber-physical systems (CPS) refers to the integration of computation and networking with physical processes. CPS is firmly established as a buzzword du jour. Yet many of its elements are familiar and not altogether new. Is CPS just a rehash of old problems designed to attract new funding?

3 Hard Problems in Large-Scale Computing

Luiz Andre Barroso, Google, Inc.

(telecast from Duke)

Monday, November 18, 2013

As the field of warehouse-scale computing matures we continue to find new and interesting problems to solve. Some of the most interesting problems are the ones that are trivial to explain once identified, and yet remain very hard to solve. I'll present three examples of such problems drawn from our experience building and operating large computing systems at Google.

What Google Glass Means for the Future of Photography

Marc Levoy, Stanford University

(telecast from UNC)

Monday, October 28, 2013

Although head-mounted cameras (and displays) are not new, Google Glass has the potential to make these devices commonplace. This has implications for the practice, art, and uses of photography. So what's different about doing photography with Glass? First, Glass doesn't work like a conventional camera; it's hands-free, point-of-view, always available, and instantly triggerable. Second, Glass facilitates different uses than a conventional camera: recording documents, making visual todo lists, logging your life, and swapping eyes with other Glass users.