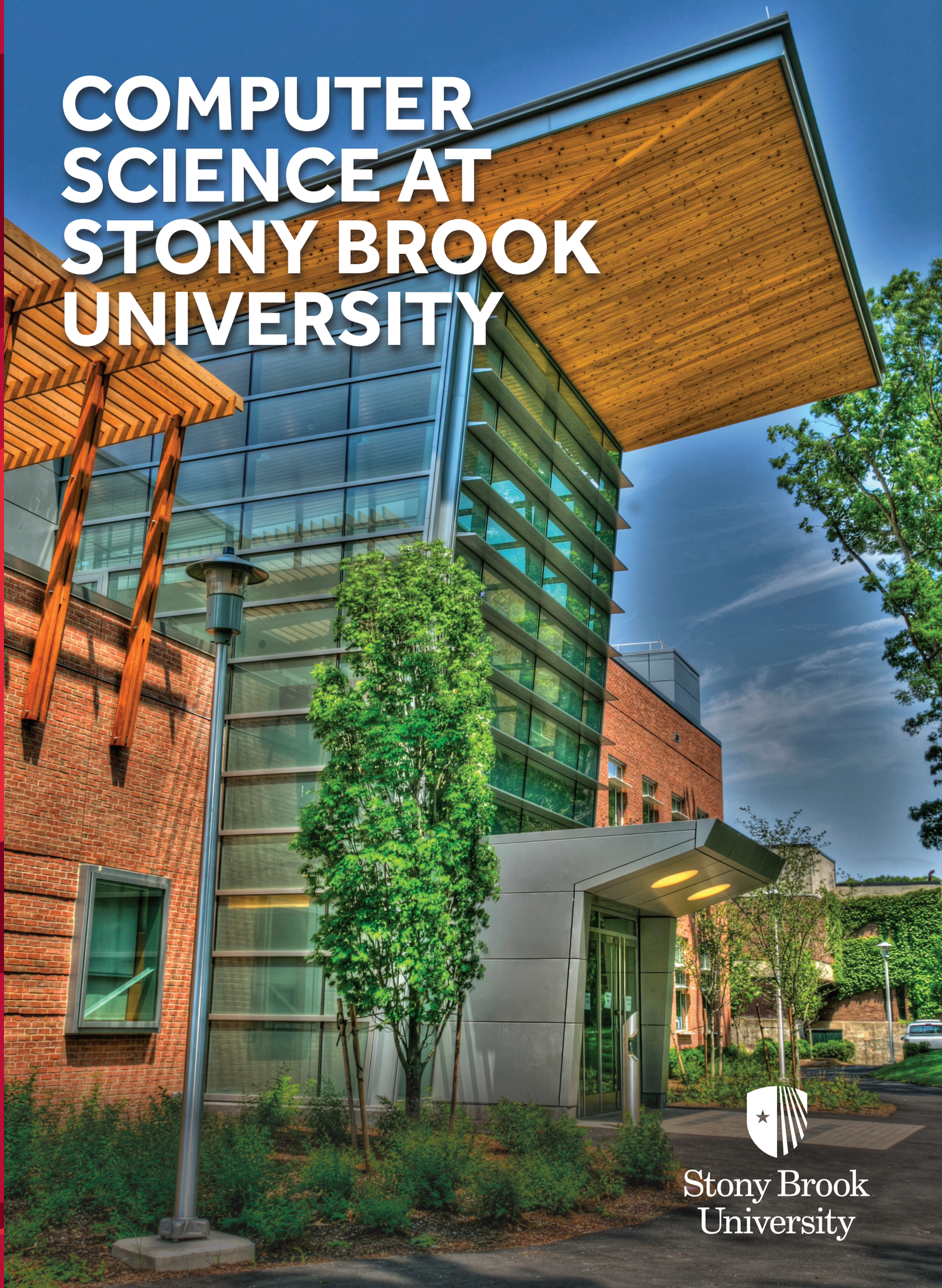
COMPUTER SCIENCE AT STONY BROOK UNIVERSITY



Stony Brook University

FROM THE CHAIR

Computer science at Stony Brook University remains on a strong trajectory of growth and excellence as we emerge from the Covid-19 pandemic and return to in-person learning. In the last 3 years, our research expenditure increased by 25% reaching an all-time high of $13.2M. In this period, the department also welcomed eight new faculty members, including multiple SUNY Empire Innovation Professors. These individuals add significant new skills to the department in AI and quantum computing, and bolster our strength in computer systems.

Our faculty continue to be honored for their accomplishments. Nick Nikiforakis and Omkant Pandey received NSF CAREER awards for their security research. Scott Smolka, Michael Bender and Erez Zadok were ACM honorees and Aruna Balasubramanian and Anshul Gandhi received Rising Star awards from ACM SIGMOBILE and ACM SIGMETRICS, respectively. Nick Nikiforakis, Andrew Schwartz and Stanley Bak received prestigious young investigator/ faculty awards from defense agencies. Kevin McDonnell, Paul Fodor, and Erez Zadok received SUNY Chancellor awards. Arie Kaufman and Klaus Mueller were inducted into IEEE Visualization Academy for their longstanding contributions to the field of visualization. Scott Smolka was honored with the Dijkstra Prize in distributed computing.

As the largest producer of undergraduate and doctoral degrees in computer science in New York, we have been quite successful in expanding computing education. One example is the integration of computational thinking in first-year curricula across campus through a "digital intelligence" course. Co-taught by faculty in computer science and humanities, to date this class attracted robust enrollment with 500+ students participating.

As we kick-off our 53rd academic year, we're excited to share this brochure with you which highlights recent faculty accomplishments and novel research in the areas of security, AI, and engineering-driven medicine.

Samir R. Das, PhD
Professor and Department Chair

MEET OUR ACM SIGMOBILE ROCKSTAR: ARUNA BALASUBRAMANIAN

Aruna Balasubramanian, associate professor in the Department of Computer Science, was selected for the ACM, early career SIGMOBILE Rockstar award. ACM SIGMOBILE is the international professional organization for scientists, engineers, executives, educators, and students dedicated to all things mobile. The award recognizes Balasubramanian's outstanding contributions to the field of mobile computing. This recognition revolves around her "significant contributions in the areas of mobile systems and mobile Web performance, and mentoring and leadership efforts in improving diversity in the SIGMOBILE community."

Balasubramanian's research contributions are at once deep and bold. One research thread that exemplifies her work is on understanding the performance of web access, particularly from mobile devices. She has developed multiple insights in the matter of understanding web access and analyzing various performance measures. Another thread that shows the depth of her research contributions is in the area of mobile power consumption and the significant energy benefits of offloading mobile workloads from the device to the cloud. Similarly, sensing tasks can be offloaded from the device to a low-end microcontroller for power savings. She analyzes the critical problem of sustainable Natural Language Processing (NLP) by modeling energy consumption of large NLP applications requiring enormous amounts of energy.

Several of Balasubramanian's research projects have strong societal impact. Her PhD dissertation focused on improving Internet access under extreme disconnection – due to lack of infrastructure or due to natural disasters. She demonstrated how to modify operating systems to adapt smartphone interactions for blind users for significant power savings.

Samir Das, chair of the Department of Computer Science, said, "Aruna is a renowned early career researcher who has made significant contributions to mobile web performance and other aspects of mobile computing."

COMPUTER SCIENCE DEPARTMENT AT-A-GLANCE

Full-time Faculty
57

NSF CAREER Awardees
19

SUNY Empire Innovation Professors
7

Fellows/Distinguished Members of Professional Societies
8

The Department of Computer Science is part of the College of Engineering and Applied Sciences (CEAS). CEAS recently conferred nearly

1,400 degrees

Annual Research Expenditure
$13.2M

Rankings

#24
csrankings.org

#43
US News and World Report

Undergraduate Students
1,380

MS Students
327

PhD Students
218

Data accurate as of August 2022.

DOODLE FINN WINS 18TH ANNUAL GAMING COMPETITION

Stony Brook University's popular Game Programming Competition, presented by the Department of Computer Science (CS), gives student game developers an opportunity to create a variety of different games. The competition was presented in a hybrid format with finalists in-person and livestreaming via Stony Brook Game Developer's Twitch channel.

Eleven finalists participated, showing off original games they created in CSE 380 Computer Game Programming and CSE 381 Advanced Game Programming. The panel of 24 judges included several Stony Brook computer science alumni from a number of companies including Google, NoizIVy, Paramount, Rockstar Games, and Microsoft.

Judges had the difficult task of determining which game finished at the top of the leaderboard. That honor went to "Doodle Finn," created by students Kevin Cai, Eric Chiu and Anna Noonan. "The idea was a dungeon crawler game called DoodleDungeon, where the player flings their inkbrush to attack and defend themselves," said Cai, who came up with the original concept.

The runner-up was the game "Terminal," developed by Thomas Aloi, Kazi Jamal and Jaswinder Singh. Terminal was created using the Wolfie2D game engine written in typescript and created by Joe Weaver and Prof. Richard McKenna.

Visit **www.cs.stonybrook.edu/~games/** for links to playable versions of all of the games. A video of the entire event, game video trailers and information regarding past events can be found on the SBU Game Programming's YouTube channel.

BRAVO! HONORS & AWARDS

CELEBRATING
Professor Scott Smolka Named a 2021 ACM Fellow

In recognition of his role in advancing society, Distinguished Professor of Computer Science, Scott A. Smolka was elected as a Fellow of the Association for Computing Machinery (ACM).

Smolka's contribution spans a number of computing fields including process algebra, model checking, and runtime verification. His creativity and fundamental contributions exemplify an ACM Fellow which is an honor bestowed on only the top 1% of ACM members.

Prof. Smolka is best known for the algorithm he and Paris Kanellakis invented for deciding bisimulation, a fundamental notion of equivalence for concurrent processes. This algorithm, known as the K-S Relational Coarsest Partitioning algorithm, can be used to efficiently decide bisimulation equivalence, a cornerstone of Milner's CCS and other process-algebraic formalisms, in polynomial time.

Smolka is a Fellow of the European Association on Theoretical Computer Science (EATCS). He also received 2021 Edsger W. Dijkstra Prize In Distributed Computing.

Smolka's research has received $25M+ in funding and has resulted in over 200 publications, generating more than 10,000 citations. One of his most recent roles is serving as the lead PI on a $5M multi-institutional NSF CPS Frontiers grant on Compositional, Approximate, and Quantitative Reasoning for Medical Cyber-Physical Systems, CyberCardia.

COMPUTING HONORS
Professor Erez Zadok Named ACM Distinguished Member

Professor Erez Zadok was selected as a Distinguished Member of the Association for Computing Machinery (ACM), the world's "largest and most prestigious society of computing professionals."

This honor acknowledges Zadok's outstanding scientific contributions as a well-recognized expert in computer systems with a special focus on storage and management of large-scale data. He has published extensively and held many leadership roles in ACM and USENIX.

Samir Das, department chair in the Department of Computer Science, said, "Erez's research has tackled the vexing challenges of large-scale, secure data storage systems for three decades. Congratulations to Erez on the heroic accomplishment that he richly deserves. Not only does the department benefit from his knowledge and outreach, but the computing community does as well."

Zadok is well known for his work on file systems and storage, operating systems, energy efficiency, security, and performance and benchmarking. Zadok earned his PhD in computer science at Columbia University and has been a Stony Brook University faculty member since 2001. In addition to being part of the Smart Energy Technology group, Zadok directs the File Systems and Storage Lab (FSL).

SECURING AGAINST QUANTUM ADVERSARIES
Omkant Pandey Receives NSF CAREER Award

The National Science Foundation (NSF) has once again recognized research excellence in the Department of Computer Science at Stony Brook University by awarding Omkant Pandey a Faculty Early CAREER Development grant.

Pandey's CAREER research focuses on how to secure our computer systems against an adversary equipped with quantum computing technology. Quantum computers can be much faster than traditional computers and can break almost all the cryptographic systems in deployment today that are used to secure data on the Internet.

The threat of quantum computers thus needs to be taken seriously when designing secure cryptographic protocols. The goal of Pandey's grant is to build cryptographic protocols for securely performing tasks on the Internet while protecting against adversaries equipped with quantum computers. Pandey's CAREER research also focuses on developing new techniques for proving security of cryptographic protocols without copying the quantum information.

Working with a team of PhD students in his lab, this $400k+ in NSF research funding builds on Omkant's early efforts as part of the National Security Institute (NSI) at Stony Brook University and broadens the reach of secure computational methodologies.

RESEARCH ADVANCES

EXTENDING OUR REACH

Introducing myARM Tech and SeeSayClick

myARM Technology and SeeSayClick are two exciting research projects focused on improving daily living for individuals with significant locomotor disability (SLD).

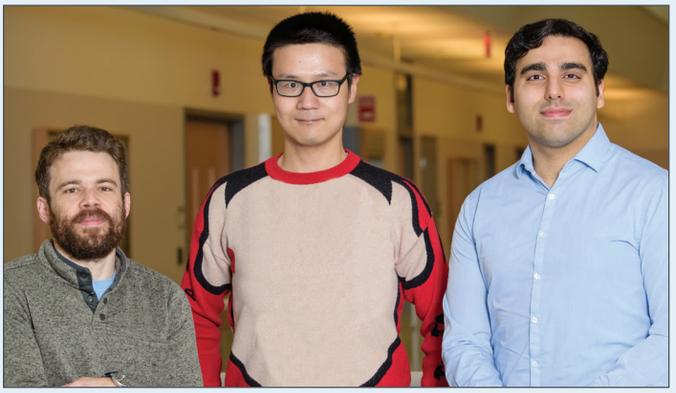
Six researchers from computer science and mechanical engineering work alongside Prof. Brooke Ellison from the Center for Medical Ethics, Compassionate Care, and Bioethics. Not only does Ellison bring her extensive knowledge to the team but as an individual with quadriplegia she inspires the team and is able to "test-drive" developments.

SeeSayClick–Xiaojun Bi leads the NSF-funded, Bayesian-centric Multimodal Hands-free Computer Interaction Technologies for People with Quadriplegia. Co-PI's IV Ramakrishnan and Ellison are working with Bi to develop hands free computer interaction techniques for people with quadriplegia.

SeeSayClick is an assistive multimodal interaction system consisting of hands-free interaction techniques that combine inputs from different modalities that predict and act on the user's interaction intent. This project takes in locational information from the gaze, spoken commands, and prior knowledge from the interaction context to infer the intended target or action.

myARM Technology–my Assistive Robotic Manipulator (myARM) is a wheelchair-mounted robotic arm system. Working with Ellison, Prof. IV Ramakrishnan leads the project with CR Ramakrishnan, Xiaojun Bi and Haibin Ling from CS, and mechanical engineer Nilanjan Chakraborty. myArm Technology provides caregiver-guided robotic assistance to eliminate the need for the hands on control of the robot arm.

Researchers aim to provide a technical foundation that combines advances in human-computer interaction, computer vision, and robotics.



BOT HUNTERS WIN AT IEEE SYMPOSIUM

Bot Hunters Win Big!

Members of Stony Brook University's National Security Institute won the Best Film Editing Award (Most Creative Video) for Good Bot, Bad Bot: Characterizing Automated Browsing Activity at the 42nd IEEE Symposium on Security and Privacy.

The video advertised novel bot-detection research conducted by computer science professors Amir Rahmati and Nick Nikiforakis along with their students, Xigao Li and Babak Amin Azad.

Bots occupy nearly 40% of the total website-related traffic, providing services such as content discovery and indexing for search engines. Not all bots, however, are useful and helpful for users. Malicious bots are used to steal sensitive content, exploit vulnerabilities, and brute force user credentials.

Understanding the population and behavior of malicious bots is vital to creating a safe and secure online environment. Detecting bad bots is challenging since they can pretend to be benign bots operated by well-known companies or even human users.

To resolve these issues, the research team designed and built a system called Aristaeus for "deploying large numbers of 'honeysites,' i.e., websites that exist for the sole purpose of attracting and recording bot traffic." In their seven-month-long experiment, data from 100 honeysites captured 26.4 million requests with more than 287K unique IP addresses, which is more than 200GB of crawling activity.

The winning video highlights this new research and how it enables defenders to understand malicious bots at a level that was not previously possible.

SCAN THE CODE TO WATCH THE RESEARCH IN ACTION.

RESEARCH ADVANCES

BLAZING DATA TRAILS

$1.2M in NSF Funding Supports Building an AI Expert Pathologist

By capturing detailed information about how pathologists move their attention while examining whole slide imaging (WSIs), researchers from Stony Brook University's Departments of Computer Science, Psychology, and Biomedical Informatics seek to create and train AI models that predict a pathologist's attention behavior. The ultimate goal of this research, according to the lead investigator Dimitris Samaras, is to lay the groundwork for developing decision support methods to support pathology diagnoses.

When looking for cancer in clinical slides, pathologists move the focus of their attention around the slides in complex ways. These skilled shifts of attention are critical to how pathologists make expert diagnoses. This research seeks to understand these shifts in attention in order to build an artificial intelligence (AI) system that will be able to look at a slide the way a human pathologist would.

Co-investigator Joel Saltz says, "Building an "AI expert pathologist" requires a lot of data for it to learn, just like a pathologist needs years of training to become an expert. In order to provide the model with many examples of expert attention behavior, essential for it to make good predictions, we are collecting a large dataset of attention behavior from human pathologists."

A large database will be created of pathologist's cursor-based movements during cancer interpretations, referred o as attention trajectories. The web-based research plan, devised by Samaras, Saltz, and fellow investigator Greg Zelinsky involves collecting a large dataset of pathologist attention trajectories using web based Whole Slide Images (WSI) viewing software developed through publicly available National Cancer Institute information. These will be collected online from pathologists searching for metastatic cancer in WSIs of lymph nodes that were excised as part of cancer surgeries. For each WSI, one of four "diagnoses" will also be collected: negative, small, medium, or large metastases.

The pathologists' behavior serves as input to the AI model, enabling the AI system to model and reproduce how the human pathologists expertly sample the slides by moving their focus of attention. Using Inverse Reinforcement Learning, the AI system will learn to "imitate" a human expert's behavior in viewing a WSI. To deal with the limited time that experts can devote in generating training data, Active Imitation Learning techniques will be adapted to deal with the uncertainty introduced by collecting data from multiple experts.

The investigators will also build AI-fueled tools that can predict where an expert would have focused their attention in a slide, thereby giving human pathologists feedback from the AI pathologist.

Improving human accuracy of cancer diagnoses is paramount to improving healthcare infrastructure. The work also has the potential to improve histopathology training in medical personnel and to lead to next-generation AI models for cancer classification. The AI scientists trained through this project will be experts in building AI-tools that understand human expert performance and synergistically enhance it.

ALUMNI PORTAL

ADVICE FROM VINOD SINGHI ‘83

Vinod Singhi ‘83 is a highly accomplished alumnus of Stony Brook University’s Department of Computer Science. After completing an undergraduate degree in India, he came to Stony Brook University with the intention of beginning his graduate studies but pursued a BS in computer science instead. Vinod attributes part of his success to the education and mentorship he received from the computer science (CS) department.

Q: What would you tell a first-year student about finding help when starting out?

A: Don’t be shy. Ask for help. I did not have an advisor but I found it very easy to find help within the department when I asked for it. I came from India, not knowing much English, and I struggled to pass my English course, however, I was able to pass during my first semester. The department chair at the time, Jack Heller, and department staff members, Betty, Peggy, and Kathy were incredibly supportive and helpful in helping me navigate a path.

Q: Was there any particular course you found surprising?

A: I had no knowledge of what to expect for most of the courses, so it was all a scary surprise. I had a biology background in India so I had no real extensive knowledge of math which made CSE101 especially interesting.

Q: Do you have any suggestions on particular skills that every student should have?

A: Current undergraduate students should definitely know basic programming and be able to comprehend the required math courses for the major. Going on this specific path in CS, you need to have the ability and desire to work hard. It is important to have a balance between being personable and approachable while also having the drive to succeed. Many IT and CS students end up in the corporate world and the desire to work hard is a fundamental requirement.

Q: Can you tell me about your current occupation and how you ended up there?

A: I currently work as SuccessFactors EC and ORD Consultant, specifically with HR solution software. My first job was at Kodak in Rochester where I worked for 12 years as a Systems Analyst. Once my unit was sold to J&J, I worked as a software engineer.

I joined SAP America in 1998 as an application consultant. It was all technical consulting and after two years, I was promoted to technical lead where I managed 7-8 people. After that, I evolved with an area of expertise that only a few people were capable of handling. The client side required unique expertise with system applications and writing programs. Later on, I was a functional consultant where I led new projects for Employee Self Service applications. I eventually joined SuccessFactor within their HR Reporting division which is where I am now.

Q: Do you have any advice for our new alumni? What can you attribute to your success?

A: The key factor to my success was my demeanor when working with customers. I made sure to be a good person towards my customers. My advice would be to always deliver on your promises.

Q: You created the Nisha and Vinod K. Singhi Graduate Fellowship for Stony Brook University students. What do you hope to accomplish with this generous graduate fellowship?

A: There were multiple avenues I could have supported, but the first option for me was to support the place that allowed me the opportunity and helped me to succeed. I want to help the students who benefit from this fellowship to realize their dreams and goals. The ultimate reward would be to see the Singhi Fellows graduate and to have them be part of the vision and the legacy I hope to leave behind.

A CRA FELLOWSHIP AWARD FOR DR. TAPTI PALIT ‘21

Newly minted PhD alum, Tapti Palit, earned a CIFellows award for her research titled “Towards Secure Browsers’’ which focuses on software security and program analysis. Since winning the fellowship, Palit has been working as a systems postdoctoral researcher with Dr. Pedro Fonseca at Purdue University.

Palit’s CIFellowship research project explores various novel static analysis approaches to facilitate efficient and fine-grained privilege separation in web browsers and other Javascript and Web Assembly environments. Professor Michalis Polychroniakis in the Department of Computer Science at Stony Brook University advised Palit throughout her doctoral studies.

The CIFellows program was created by the Computing Research Association (CRA) and the Computing Community Consortium (CCC), with strong support from the National Science Foundation (NSF).




WELCOME

Since 2020, the Department of Computer Science added to its course offerings and research depth by welcoming new faculty who focus on a number of research topics, including:

- **Stanley Bak** Cyber-physical systems, hybrid systems
- **Omar Chowdhury** Computer security and privacy
- **Jalaa Hoblos** Computing education
- **Shubham Jain** Smart environments and cyber-physical systems
- **Dominik Kempa** Data compression, bioinformatics
- **Joydeep Mitra** Mobile security, software engineering, and computing education
- **Supartha Podder** Quantum computing, complexity theory, quantum cryptography
- **Yifan Sun** Optimization for machine learning and scientific computing

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