
R E U
Computer
VISION
Lab
University of Central Florida
U C F
20 YEARS

NSF REU IN COMPUTER VISION

◊ In 1987, NSF designated the Computer Vision Lab at UCF as a national site for Research Experience for Undergraduates in Computer Vision. ◊ The goal of REU is to encourage talented undergraduates to pursue graduate school and realize their full potential in this regard. ◊ Mubarak Shah, during his first year as an assistant professor at UCF, was the sole PI for this project. ◊ From 1989 to 1990 two other faculty members: Kevin W. Bowyer from USF, and Ganapathy Krishnan from Stetson University, also joined the project. ◊ The project continued with the same mix of faculty and students from three institutions for the next two years . At the end of 1991-92, Ganapathy Krishnan decided not to continue. ◊ For the next two years Shah and Bowyer continued this project. ◊ From 1995 to 1998, two new faculty, Louise Stark from the University of Pacific and Niels da Vitoria Lobo from UCF, joined the project. ◊ At the end of this period, Kevin Bowyer dropped out of the program. ◊ From 1999 to 2001, all three faculty (M. Shah, N. Lobo and Art Weeks) were from UCF. ◊ This project continued for the next five years (2001-2006) with the three UCF faculty (M. Shah, N. Lobo and Takis Kasparis). ◊ In 2006, another three year REU grant was awarded that will run through 2009.

NSF GRANTS

- IRI 8713120 ($40,00)
- IRI-8900798 ($56,243)
- CDA-9000802 ($75,000)
- CDA-9100898 ($62,500)
- CDA-9200369 ($78,350)
- CDA-9424214 ($174,00)
- EI-9732522 ($350,000)
- EIA-0097738 ($280,00)
- IIS-0552807 ($300,000)

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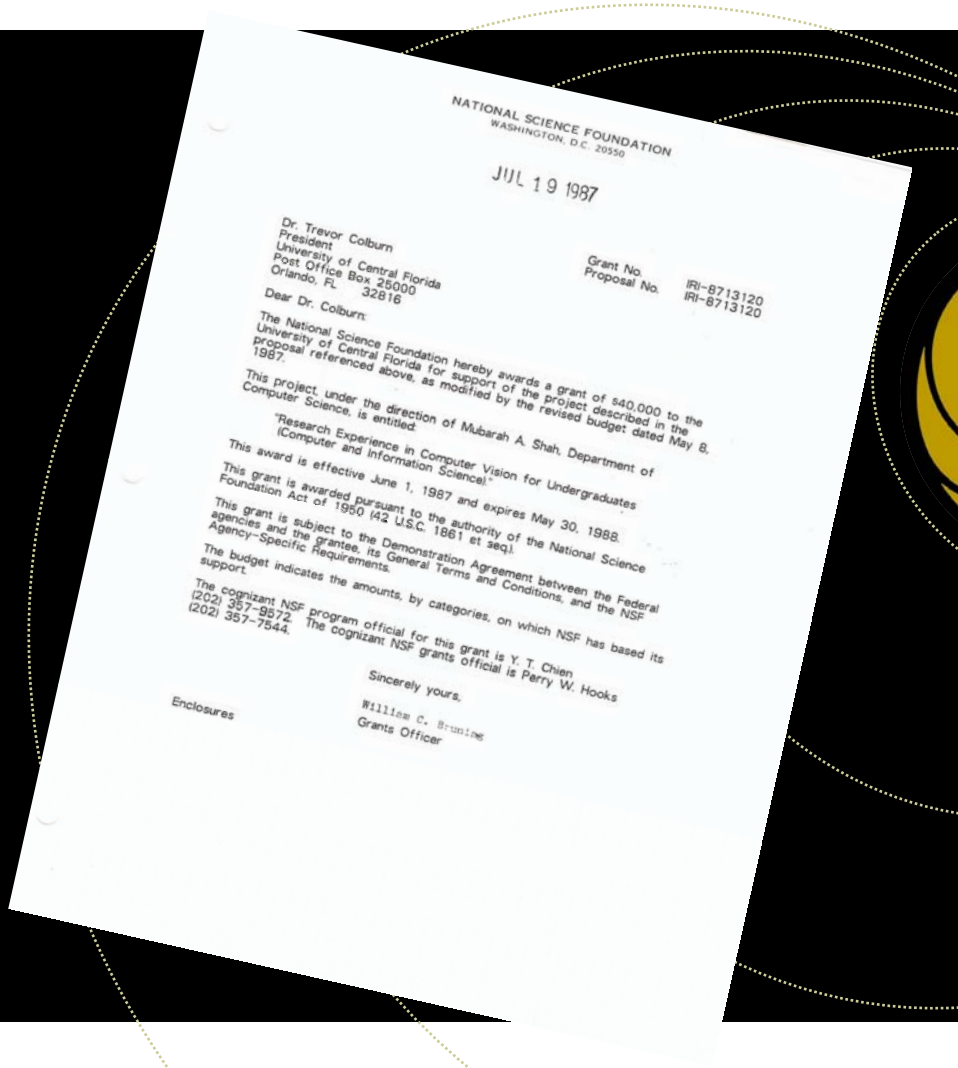


NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

JUL 19 1987

Dr. Trevor Colburn
President
University of Central Florida
Post Office Box 25000
Orlando, FL 32816

Grant No. IRI-8713120
Proposal No. IRI-8713120

Dear Dr. Colburn:

The National Science Foundation hereby awards a grant of $40,000 to the University of Central Florida for support of the project described in the proposal referenced above, as modified by the revised budget dated May 8, 1987.

This project, under the direction of Mubarah A. Shah, Department of Computer Science, is entitled:

"Research Experience in Computer Vision for Undergraduates (Computer and Information Science)."

This award is effective June 1, 1987 and expires May 30, 1988.

This grant is awarded pursuant to the authority of the National Science Foundation Act of 1950 (42 U.S.C. 1861 et seq.).

This grant is subject to the Demonstration Agreement between the Federal agencies and the grantee, its General Terms and Conditions, and the NSF Agency-Specific Requirements.

The budget indicates the amounts, by categories, on which NSF has based its support.

The cognizant NSF program official for this grant is Y. T. Chien (202) 357-9672. The cognizant NSF grants official is Perry W. Hooks (202) 357-7544.

Sincerely yours,

William C. Brunine
Grants Officer

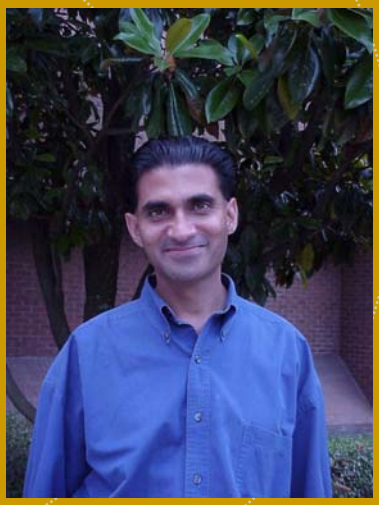
Enclosures

NSF REU IN COMPUTER VISION

◊ Close to two hundred undergraduates from more than twenty-five different institutions all over the country have participated in this program. ◊ These undergraduates have co-authored more than seventy research papers. ◊ About half of these students have gone to graduate schools, and several of these students are now faculty members at different schools or have started their own companies. ◊ A 1989-1990 participant from USF, Maha Sallam, cofounded a company, which now employs 100 people and generates a revenue of $20 million. ◊ At UCF, fourteen undergraduates have completed Honors in the Major Theses on their REU projects. ◊ In 2000, Andrew Wu, REU participant from UIUC, won a Honeywell award, which is given only to a single junior in the College, for his REU project. ◊ In 2001, Paul Smith received the Barry Goldwater award, a first ever for UCF, on his REU project. ◊ In 2003, Ankur Datta was the finalist for CRA outstanding undergraduate award and received a three year NSF fellowship for his Ph.D. at CMU.

PRINCIPAL INVESTIGATORS

Mubarak Shah, UCF



Niels da Vitoria Lobo, UCF

Takis Kasparis, UCF

PRINCIPAL INVESTIGATORS

Kevin Bowyer, USF

Now at University of Notre Dame

Ganapathy Krishnan, Stetson University

Now at Krishnan Consulting

Louise Stark,

University of Pacific

Art Weeks, UCF

REU MODEL

Key Elements of Our REU

- Full calendar year of experience.
- Immerse participants in research like graduate students.
- Assign each participant a faculty member from his or her own school.
- Follow through over the year.

Some Observations

- Students need a strong background in:
  - Mathematics
  - Programming
- The first few weeks of summer are crucial.
- Some students realize their full potential after REU.
- Some students do not want to commit to a particular area.

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Students Activities

Activity	Frequency	Dates
Computer Vision Short Course	Every Mon—Wed—Fri	May 25—June 15
Research Presentations/Topic Selection	Ten days	June 16—June 30
Ethics and Computing	Four lectures	July 15—July 22
Research Project		
Initial project selection	-	June 16—June 20
Focused research activity	-	June 27—August 12
Poster Presentation	One event	August 1
Optional Follow-up: Write Report/ Paper	Every two weeks	August—April
Teacher-Faculty Interaction		
Individual Meetings	Weekly	Summer
UCF Research Group Meetings	Weekly	Summer
REU Group Meetings	Weekly	Summer
Distinguished Speaker Series	Twice	Summer
Participation in Professional Meetings	Once	Summer
Career Mentoring (Fall/Spring)	As needed	Year round to apply to grad
Social Events		
BBQ Cook-out	Once	Mid-June
Buffet Lunch	Twice	Late-June & Late-July
REU Banquet	Once	August 5
Party with Distinguished Speaker	Once	Summer
Party for Graduating Ph.D. Student	At least once	Summer

REU MODEL

STUDENT PARTICIPANTS

1987-1988

Jay Hackett
Kristine Gould
Sanjay Kapur
John Weidner
Robert Hunt
Ofir Eyl
J. Lachawani

1989-1990

Jim Cryer
Robert Franceschini
Matt Lavoie
Gary Ramah
Randy Bolling
Thor Raabe
Maha Sallam
Katrina Simpson
Elizabeth Brooks
David Randolph
Jay Stryker

1992-1993

Julie Nichols
Fred Coulter
Adam Hoover
Natalie Bennett
Gary Hubiak
Katharine Keiter
Sean Ramsey
Chris Stimac
Barry Bruno

1993-1994

John Adair
Gillian Jean-Baptiste
Diana Burkette
Chris Doss
Jesse Campos
Jim Davis
Heath Glandon
Warren Macchi
Deborah Snead
Anna Ortega
Pam Musgrove

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STUDENT PARTICIPANTS

1990-1991

Glenn Martin
Michelle Rueda
Sundar Sinnappan
Derek Tolley
David Jones
Bob Pankratz
Avare Stewart
Bonnie Kaiser
Edward Wokabi
Belinda Wilkins
Jon Altfeld

1991-1992

Bill Allen
John Delgado
Connie Lee
Melanie Sutton
Sean Tucker
Mat Clark
Julie Nichols
Adam Hoover
Natalie Bennett

1995-1996

Paul Barnowski
Phuong Bui
John Guthrie
Jaren Johnston
Sandra Sabiston
Kyong Chang
Ian Lawrance
Min Shin
Tana Cicero

1996-1997

Chris Efford
Wen-Lin Hsu
Gul Imran
Paul Prestopnik
Shvetal Shah
Sean Dougherty
Lisa Provenzano
Jin Oh
Victor Gong
Jason Mancini

STUDENT PARTICIPANTS

1997-1998

Doug Ayers
Chris Ingrassia
Kris Urrutia
Victor Olvera
Elli Portugali
Shannon Thrasher
Sean Dougherty
Glen Parker
Shane Dunn
Matthew Krebs

1998-1999

Julie Rogers
Daniel Kristjansson
Stefan Dragolov
Sharon Cole
Michael Wallick
Steven J. Huey
Hai X. Nguyen

2001-2002

Jigna Bhatt
Ankur Datta
Jaime Dever
David Diel
Kristopher Fieler
William Grissom
Alfred Levy
Sean Szumlanski
Joanna Walker
Joseph Wilson
Xiaron Zheng

2002-2003

Josh Hight
Todd Gillette
Danny Yuen
Meng Ly Lay
William Yip
Steven Kreyenbuhl
Kevin Armstrong
Madhvi Kansagara
Lorraine Harrington
Chris Elwell

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STUDENT PARTICIPANTS

1999-2000

Ibrahim Merchant
Andrew Wu
Robert Aylesworth
Kevin Neff
Daniel Hurley
Neill Lott
Raymond Paul Smith
Merrill McKee
Dorota Woodbury

2000-2001

Alison Austin
David Bracewell
Rex Hoffman
Chris Martin
Tamara Miller
Ashish Myles
Rusty Phillips
Richard Russo

2003-2004

David Batz
Michael Batz
Justin Garcia
Victor Ortenberg
Chris Chun-Ning Poon
Chris Subich
Michael Wells
Chance Yohman

2004-2005

Patrick Delfert
Macpherson Delva
Ross Diankov
Peter Humke
Eric Lynch
Chris Pendley
Chris Schwarz
Casey Thurston
Angelica Warren

STUDENT PARTICIPANTS

2005-2006

Miko Charbonneau
Shayne Czyzewski
Jason Feinstein
Carlos Flores
Jonathan Jarvis
Jan Prokaj
Vladimir Reilly
Phillip Rydzewski
Chris Schwarz
Mike Sollami
Gregory Yoblin

2006-2007

Robert Barbier
Michael Bok
Adam Kavanaugh
Edward Guldemond
Daniel DeBlasio
Matthew Banner
Brian Byrne
Daniel Courtney
David Chiong
Dan Pencoske
Lillian Juarez
Charles Percival (RET)
Timothy Gallagher (RET)

2007-2008

James Painter
Ben Schoepke
Maya S. Shoham
Jenny Han
Adam B. Yeh
Taylor Goodhart
Drew Glazer
Riyaz Nazerali
Joshua Sheetz
Andrew Miller
Paul Ackerman (RET)
David Pollock (RET)

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◊ University of Wisconsin ◊ University of Illinois
◊ Florida Institute of Technology
◊ University of Central Arkansas
◊ Cornell University
◊ University of Southern California
◊ Transylvania University
◊ College of William and Mary
◊ University of Nevada, Reno
◊ University of California, Berkeley
◊ Stetson University
◊ Yale University

◊ City College of New York
◊ Rollins College ◊ FAMU
◊ Vanderbilt University
◊ University of Tennessee
◊ Winston Salem State University
◊ University of Texas Pan American
◊ SUNY Brockport ◊ Trinity College
◊ University of Pacific ◊ Fairfield University
◊ New York University ◊ University of Michigan
◊ University of South Florida
◊University of South Dakota
◊ Swarthmore ◊ Georgia Tech

INSTITUTIONS

PAPERS BY REU STUDENTS

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[2] **A. Miller**, M. Shah, "Foreground Segmentation in Surveillance Scenes Containing a Door," ICME, 2007.

[3] J. Ahmed, M. Shah, **A. Miller**, D. Harper, M.N. Jafri, "A Vision-Based System for a UGV to Handle a Road Intersection," AAAI , 2007.

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[5] **J. Prokaj,** N. Da Vitoria Lobo, "Scale Space Based Grammar for Hand Detection," Springer Lecture Notes in Computer Science, Vol 4153/2006, pp. 17–26.

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[7] **D. Batz, M. Batz**, N. Da Vitoria Lobo, M. Shah, "Visual System for Monitoring Medication Intake," in Proc. CRV2005, May 2005.

[8] **J. Garcia**, N. Da Vitoria Lobo, M. Shah, **J. Feinstein**, "Finding Heads in Single Images," in Proc. CRV2005, May 2005, Victoria.

[9] **A. K. Levy III**, N. Da Vitoria Lobo, M. Shah, "Object Tracking in Low Frame-Rate Video," in Procs IMVIP2004, 2004.

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[14] **Dever J.,** da Vitoria Lobo N., Shah M., "Automatic Visual Recognition of Armed Robbery", ICPR-2002.

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[16] **Myles A.**, da Vitoria Lobo N., Shah M., "Wheelchair Detection in a Calibrated Environment", ACCV 2002.

[17] **Russo R.**, da Vitoria Lobo N., Shah M., "A Computer Vision System for Monitoring Production of Fast Food", ACCV 2002.

[18] **Wallick M.**, da Vitoria Lobo N., and Shah M., "A System for Placing Videotaped and Digital Lectures Online", *International Symposium on Intelligent Multimedia, Video and Speech Processing*, 2001.

[19] **Bracewell D.B.**, da Vitoria Lobo N., Shah M., "Human identification through body measurements", *Proceedings of Computers and Their Applications*, 2001.

[20] **Rusty Phillips**, Niels da Vitoria Lobo, Mubarak Shah, "Fire Detection in Video Sequences", IEEE WACV, 2002..

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[21] **Paul Smith**, Mubarak Shah and Niels da Vitoria Lobo, ”Detecting Driver Alertness”, ICPR, 2000.

[22] **Wallick, M. N.**, Niels da Vitoria Lobo and Mubarak Shah, ”Computer Vision Framework for Analyzing Projections from video of Lectures.” Proceedings of the ISCA, 2000.

[23] **AndrewWu**, Mubarak Shah and Niels da Vitoria Lobo, “Virtual Blackboard”, International Conference on FGR,2000.

[24] Ruo Zhang, Ping-Sing Tsai, **James Cryer** and Mubarak Shah, “ Shape from Shading: A Survey”, IEEE Transactions on PAMI, 1999.

[25] **A. Ortega** and M. Shah, “From Shading to Object Recognition”, International Journal of Artificial Intelligence and Pattern recognition, 1998.

[26] **D. Ayers** and M. Shah, “Recognizing human actions in a static room”, IEEE WACV, 1998.

[27] Piotr Windyga, **Chris Ingrassia** and Mubarak Shah, “A non-linear filter for impulsive noise reduction”, Proceedings of Joint Conference of Information Sciences, 1998.

[28] **S. Dettmer**, A. Seetharamaiah, L. Wang and M. Shah, “Model-based approach for recognizing human activities From Video Sequences”, *NSF Workshop on Recent Advances in Computer Vision*, Karachi, Pakistan, January 1-2, 1998.

[29] **James Davis** and Mubarak Shah, “Toward 3-D Gesture Recognition”, *Pattern Recognition and Artificial Intelligence* journal, May 1999.

[30] **Paul Prestopnik** and Mubarak Shah, “Manipulating MR/CT Data With Hand Gestures”, Sixth International Conference , on Intelligent Systems, 997.

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[32] **Tana Cicero**, “Design of a Stereo Robot Head: Hardware and Software Issues”, IEEE Region 6 - Central Area, student paper contest winner, 1996.

[33] Li Nan, **Shawn Dettmer**, and Mubarak Shah, “Visual Lipreading Using Eigensequences”, *International Workshop on Automatic Face and Gesture Recognition”*, 1995.

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[35] **J. Davis** and M. Shah. “Visual Gesture Recognition”, *IEE Vision, Image and Signal Processing*, April 1994.

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[40] **J. Hackett, M. Lavoie,**, and M. Shah, “Object recognition using multiple sensors”, *Journal of Information Sciences and Technology*, 1992.

PAPERS BY REU STUDENTS

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[40] **J. Hackett, M. Lavoie,**, and M. Shah. Object recognition using multiple sensors. *Journal of Information Sciences and Technology*, 1992.

[41] **James Cryer**, Ping-Sing Tsai and M. Shah. "Integration of Shape From X Modules: Combining Stereo and Shading", *IEEE CVPR*, 1993.

[42] Krishnan Rangarajan, **Bill Allen**, and Mubarak Shah, "Matching Motion Trajectories", Pattern Recognition, Vol. 26, No. 4, pp 595-610, April 1993.

[43] **J. Hackett, M. Lavoie**, and M. Shah, "Three Dimensional Object recognition using multiple sensors", *Journal of Information Science and Technology*, October 1992

[44] K. Rangarajan,**W. Allen**, and M. Shah. "Recognition using motion and shape". In *ICPR*, 1992.

[45] **J. Hackett**, and M. Shah. Segmentation using range and intensity data. *Optical Engineering*, pages 667–674, June 1989.

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[66] **D. Randolph**, and G. Krishnan, "Off-Line Machine Recognition of Forgeries," in the Proceedings of OE/Boston '90, November, Boston.

[[67] **W.L. Larsen**, and K.W. Bowyer,. "Computing the Hough Transform on a Switch-Based MIMD Machine," *Conference on Recent Advances Robtics*,1990

[68] **M.Y. Sallam**, and K.W. Bowyer, "Generalizing the Aspect Graph Concept to Include Articulated Assemblies", *Pattern Recognition Letters* **12** (3), 171-176, 1991.

[60] **Sutton, M.**, Stark, L. and Bowyer, K.W, "Capturing Function in a Generic Representation Scheme", *Eighth Israeli Symposium on Artificial Intelligence and Computer Vision*, , Israel ,1991,

[61] **E. Wokabi**, D.B. Goldgof, and K.W. Bowyer, "Surface Modeling for Non-rigid Motion Analysis", *FLAIRS*, Cocoa Beach, Florida, 1990..

[62] **B.Wilkins**, D. Goldgof, and K.W. Bowyer, " Toward computing the aspect graph of deformable generalized cylinders," *SPIE #1468: Applications of AI IX*, 1991.

[63] **M.Y. Sallam**, and K.W. Bowyer., "Computing the Visual Potential of Articulated Assemblies", *ICCV*, 1990..

[69] **M. Sallam**, and K.W. Bowyer, "Representing the Visual Potential of a Non -Rigid Assembly of Parts," *FLAIRS*, 1990.

[70] **K. Simpson**, and K.W. Bowyer, " Using Saccadic Eye Movements to Create a 2.5-D Sketch", *FLAIRS*, 1990.

[71] **R. Bolling**, and K.W. Bowyer, "Towards Computing the Aspect Graph of Constructive Solid Geometry Objects", *FLAIRS*, 1990.,

[72] **B.J. Kaiser**, K.W. Bowyer, and D.B. Goldgof, "On exploring the definition of a range image aspect graph, *Proc. of the 7th Scandinavian Conf. on" Image Analysis*, 1991.

[73] **Altfeld, J.**, Jones, J. and Bowyer, K.W, " Comparing A*/branch-and-bound parallel algorithms for use in path planning on an Intel hypercube," *Florida Artificial Intelligence Research Symposium*, 1991.

PAPERS BY REU STUSENTS

Honors in the Major Theses by REU Students

Jan Prokaj
Topic: Hand Detection
Graduation Date: Fall 2006

Chris Schwartz
Topic: Hand Pose Detection
Graduation Date: Fall 2006

Vladimir Reilly
Topic: Human Detection
Graduation Date: Spring 2006

Walter 'Rusty' Phillips
Topic: VHDL Design of Computer Vision Tasks
Graduation Date: Summer 2001

Chris Ingrassia
Topic: Tracking and Recognition of Coronary Arteries Angiograms
Graduation Date: Fall 1998

Doug Ayers
Topic: Monitoring Human Behavior in An Office Environment
Graduation Date: Spring 1998

Jaime Dever
Topic: Automatic Visual Recognition of Armed Robbery
Graduation Date: Fall 2005

Alfred Levy III
Topic: Object Tracking in Low-Frame-Rate Video Sequences
Graduation Date: Spring 2004

Ankur Datta
Topic: Gait-based Recognition
Graduation Date: Spring 2004

Michael Wallick
Topic: Computer Vision Framework for Analyzing overheads
Graduation Date: Spring 2001

Anna Ortega
Topic: From Shape from Shading to Recognition
Graduation Date: Fall 1994

Warren Macchi
Topic: Modeling Rough Interreflections
Graduation Date: Summer1994

James Davis
Topic: Recognizing Hand Gestures
Graduation Date: Spring 1994

Matt Lavoie
Topic: Object Recognition using Multiple Sensors
Graduation Date: Spring1991

Photos

Goldwater Scholarship winner Paul Smith.

April 5, 2000

UCF COMPUTER WHIZ WINS GOLDWATER SCHOLARSHIP

Dean McFall, UCF News and Information, 407 823-2947

A former high-school track star and current computer whiz at the University of Central Florida is one of 309 college students from across the country to win a 2000-2001 Goldwater Scholarship, the nation's premier award to undergraduates concentrating in mathematics, the natural sciences or engineering.

The Barry M. Goldwater Scholarship and Excellence in Education Foundation today announced that Raymond (Paul) Smith, 20, a junior majoring in computer science and a member of UCF's Honors College, has been tapped as a Goldwater Scholar in competition among 1,176 applicants who were nominated by the faculties of colleges and universities nationwide. Smith's one-year scholarship will cover the cost of tuition, fees, books and room and board up to a maximum of $7,500 in his senior year.

Smith is the first UCF recipient of the Goldwater Scholarship.

One of 12 Goldwater Scholarship winners from Florida this year, Smith, who sports a perfect 4.0 grade point average, intends to eventually earn a Ph.D. in computer science and pursue research. He is a 1997 graduate of Titusville High School and the son of Titusville residents Bill and Linda Smith. While in secondary school, Smith represented his high school in the 400-meter dash at the Florida State High School track meet.

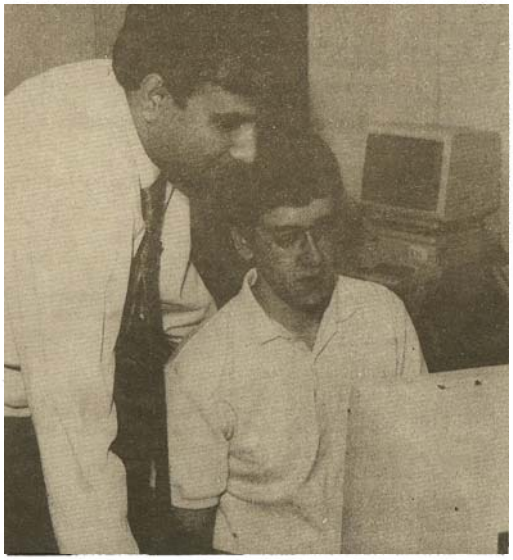
Last summer, Smith participated in the "Research Experience for Undergraduates" program of the National Science. In the field of computer science, his interests span language theory, system software and artificial intelligence. When he's not involved in campus community service and volunteer activities, Smith trains for the marathon.

The Goldwater Foundation, named in honor of the late Arizona senator, is supported by an U.S. Treasury trust fund, which provides funding for awards and administrative expenses.

REU IN THE NEWS

UCF REPORT

Volume 11, Number 24 | For Faculty and Staff | May 31, 1989



MUBARAK SHAH, FACULTY SPECIALIST IN COMPUTER VISION
. . .helps undergraduate researcher Matt Lavoie with a science project

Computer Science designated site for undergraduate research

NSF grant encourages study of engineering and science through the use of computer vision

The Computer Science Department has been designated by the National Science Foundation as a site for Research Experiences for Undergraduates (REU), placing UCF among 13 universities chosen by NSF to specialize in that phase of artificial intelligence known as computer vision.

Assistant Professor Mubarak Shah of UCF is the lead principal investigator with co-PIs Kevin Bowyer of the University of South Florida and Krishnan Ganapathy of Stetson University in a program that began in May and involves the three faculty members and 13 students.

UCF will serve as a central point for coordination and administration of the program. The existing, active computer vision research groups at UCF and USF will anchor the program, providing the undergraduates the opportunity to interact with a number of graduate students at different stages of completion of PhD work on various topics in computer vision. The group at Stetson, which is not a PhD granting institution, will be led by a new faculty member who recently completed his PhD in the computer vision area.

The REU site will accomplish several important goals. First, it will establish a network among several geographically related institutions to influence undergraduates to consider graduate work in science and engineering. Second, it will provide well-trained graduates to the high tech industries of the state. And, it will provide quality graduate students for two PhD programs at a time when many new computer science departments are having difficulty in recruiting good PhD students.

Five juniors were selected from UCF, five from USF and three from Stetson to participate in this project. All the students are getting an introductory course in computer vision during the first two weeks and then will be introduced to various research projects in the computer vision area.

The students will work full time on the individual research project during the summer semester and continue part time during the fall and spring semesters. The stipend for the summer semester is $2,000, and for each of the fall and spring semesters is $1,000.

NSF started REU in 1987 and chose UCF to be one-of-13 national sites for REU, along with Berkley, Caltech, Cornell, Maryland, RPI and others. At UCF the first year, seven students from UCF, FIT, Stetson and Rollins participated in research experiences in the computer vision area. Most of these students are currently doing graduate work

In the first year the NSF grant to UCF was $44,000. This year it was increased to $76,000.

Mubarak earned his PhD at Wayne State University and came to UCF in 1986, introducing computer vision studies at upper and graduate levels. His specialization helped UCF become one of the universities chosen by NSF in national competition.

Computer VISION @ Lab
University of Central Florida

REU IN THE NEWS

The UCF Report

Volume 15, Number 17 | The University of Central Florida newspaper for faculty and staff | March 31, 1993

Computer science department snags sixth research project

For the sixth year the National Science Foundation has designated UCF's computer science department as a site for Research Experiences for Undergraduates in the area of computer vision.

The purpose of REU is to encourage undergraduate students to pursue careers in research. During the previous five years, more than 50 undergraduate students from a half-dozen institutions in Florida have participated in the program.

Several of the undergraduate students have co-authored papers, and most have been admitted to graduate programs. One of these students presented results of her REU project at the 1989 Computer Vision and Pattern Recognition conference, and an extended version of that paper has been published as a chapter of a book. Another REU participant worked on multi-sensor fusion, and produced results which appeared in the IEEE Conference on Robotics and Automation and in the Optical Engineering journal.

"We have not only focused on our UCF students, but have provided leadership to other institutions in Florida," said Mubarak Shah, assistant computer science professor.

For example, at least 10 REU participants from the University of South Florida and Stetson have published papers in journals and presented them at conferences. A Stetson student was awarded a Barry M. Goldwater Scholarship, one of only two students in the state to receive the honor. The award was based in part on her REU project.

The majority of REU students have completed their B.S. degrees, and have been admitted to graduate schools. Each year a number of minorities and female undergraduates participate in the program.

As part of the project, the computer science department started an REU Speaker Series two years ago. The goal is to give undergraduate students an opportunity to meet known researchers who may serve as role models. During the 1990-91 series, three researchers were invited to speak. They were the University of Massachusetts' Allen Hanson, the University of Michigan's Ramesh Jain and MIT Media Labs' Sandy Pentland.

The following year the University of Florida's Baba Vemuri, Michigan State University's George Stockman and Pittsburgh Supercomputing Center's Nigel Goddard took part in the series.

"As an indication of the success and good reputation of our REU program, we have begun to get a large number of requests for copies of our grant proposal from other investigators who are considering the submission of a similar proposal of their own," Shah said.

This year 10 students from various institutions in Florida will participate in the program. UCF will serve as a central point for coordination and administration of the program.

The program will start in May, and will last one year. Students will be given an introductory course in computer vision during the first few weeks, and then be introduced to various research projects in the computer vision field.

Students will work full-time on their individual research projects during the summer semester, and will continue working part-time during the fall and spring semesters.

Each student will be paid a stipend of $5,500.

REU IN THE NEWS

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REU returns to UCF for the seventh year

Linda Setchell
News Editor

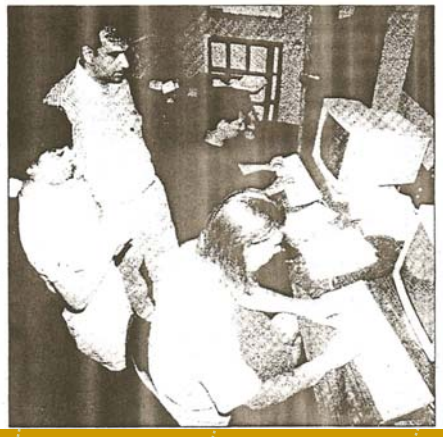
This summer began the seventh year for UCF's Computer Science department as host of Research Experiences for Undergraduates (REU), a program designed to encourage undergraduates to enter the research field after graduation. UCF's program focuses on the area of Computer Vision, a sub-sector of artificial intelligence that deals with the task of programming computers to see in the same way humans do. The process involves recording images with a video camera, than digitizing those images so they can be interpreted by a computer.

The students in the program spend the first six weeks in a short introductory course in Computer Vision. Once they've completed that, they are given several research projects to choose from. After selecting a project, they are required to read papers previously published on the subject, and discuss them with their advisor. Ultimately, their goal is to write a program that would transfer specific images from a video camera to the computer. If their program is successful, they then write a paper to submit to various conferences around the world. Shawn Dettmer, a participant in last year's program, worked on gesture recognition or lip reading. Later this summer he will do a presentation in Zurich, Switzerland.

The program began in 1987 after Congress realized there was a shortage of Ph.D.s going into research. REU was designed to encourage students to enter the field of research, by giving them hands on experience at the undergraduate level.

The program is open to students from various institutions across the state. This year's participants come from UCF, Stetson and USF. They will spend the summer here for the introductory portion of the program, and return to their respective institutions in the fall to work on their individual projects.

see COMPUTER, page 2



from COMPUTER, page 1

During the fall and spring semesters, well-known researchers are invited to UCF to talk about their work, giving students in the program the opportunity to chat with someone in their prospective field.

Computer VISION @ Lab
University of Central Florida

The UCF Report

Volume 17, No. 23 | The newsletter for faculty and staff | June 23, 1995

Inside this issue

Undergraduate students delve into research in the field of computer vision. See story on page 4.

Undergraduates try out research in computer vision

Seeing is believing—even for computers, nowadays.

UCF researchers are working to "give sight" to computers, which allows them to interpret sign language, gestures and lip reading.

The ability of computers to interpret visual signals is still in the rudimentary stage, but computer science professor Mubarak Shah and his research students are working to expand just what computers can do within the field of computer vision, which is a sub-field of artificial intelligence.

"First, we take photographs and place them in the computer in digitalized form. We can do static objects or objects in motion, and we can make them two dimensional or three-dimensional. The 3-D is produced by making two photographs of the same object, but at slightly different angles and combining them so that it creates a sense of depth perception, much as a person gets from the use of two eyes," Shah said.

A camera mounted on the computer acts as its "eyes." Then a program is written to give the computer the dimensions and characteristics for interpreting what it "sees." The program first defines the edges of an object, then its shape, its size and how it is oriented.

Shah foresees the use of computer vision in such various fields as the stock exchange, factory inspection and robotics.

"Robots need to be able to interpret visual information to help them navigate when they move. For instance, if they are moving through a hallway, they must be able to discern that a wall is an obstacle," Shah said. "Computer vision is already being used for inspection for defects on factory parts— a chore that is mundane for humans. I expect that to become more common in the near future. Even the stock exchange could use computer vision—the noise level makes it difficult to hear and there is already a unique sign language in use."

Shah's work in this field has led to another bonus for UCF and the research community. For the last seven years, the National Science Foundation has designated the UCF Computer Science Department as a site for Research Experience for Undergraduates (REU) in the area of computer vision.

A year after completing his postgraduate work at Wayne State University in Detroit, earning his Ph.D. in computer engineering and joining the UCF faculty in 1986, Shah won a grant for this program and has continued to win the same grant every year since. This year, he was awarded the REU grant for three more years.

"The REU grant is designed to give undergraduate students an opportunity to experience research for a full year, to really immerse themselves in the research environment as if they were graduate students. Most of them don't really know what it's like," Shah said. "The goal is to encourage some of these students to discover the excitement of research and to go on to graduate school and become scientists. We select 10 students a year and hope that three or four of them continue with their work."

From back to front, Mubarak Shah, professor of Computer Sciences, works with Jaren Johnston, Phuong Bui and Sandra Sabiston on their undergraduate research projects.

So far the results have been gratifying.

Students have been selected from UCF and a half dozen other Florida institutions, including Rollins College, Stetson University, Eckerd College, the University of South Florida and the Florida Institute of Technology. A number of the participants have had their research papers published and have gone on to graduate studies.

Shawn Dettner, who graduated from UCF in December 1994 and is currently a UCF graduate student, participated in the REU program, working on lip reading.

"He is developing a system that recognizes the pronunciation of letters. At this time, the computer can lip read the alphabet from A to J," Shah said. "Accuracy is at about 80 to 85 percent."

Shah believes that in the future lip reading could be combined with voice recognition—which is not 100 percent accurate—gestures and sign language to increase accuracy and also to assist the hearing impaired.

Another former undergraduate, Jim Davis, worked on sign language for his REU project. A paper on his research was accepted in the "1994 European Conference on Computer Vision" and published in a journal. He has since been accepted to the graduate program at MIT and awarded a full fellowship while he works on his Ph.D. degree.

Students are selected for the program on the basis of their academic record, but even more so on their motivation and how much work they want to do. Participants start on the yearlong program during the summer term on the UCF campus. For the first six weeks, they take a basic course in computer vision before tackling a few, short research projects.

"We assign them problems that they can most likely solve and complete in a short period of time," Shah said. "Then, we encourage them to think of new ideas and propose something they want to work on for their major project."

The summer session gradually builds into a full day with some students working long hours on their projects.

Come fall, students return to their regular school schedule. Non-UCF students are assigned a faculty adviser on their own campus to assist them with their project. Students are also brought back to UCF during the year to work in groups.

"Two or three of the undergraduates don't continue or are unable to complete their projects, but we expect that," Shah said. "This is an experimental process—some find that they are not suited for research."

Less than 10 institutions were awarded the REU designation the first year it was awarded, which included Cal Tech, Stanford and Cornell along with UCF. UCF has the only REU program in computer vision.

Not only are more researchers being added to the scientific community through the REU program, but forward movement is being accelerated in the computer vision field not only through Shah and his colleagues' work, but the undergraduates who go on to work in this field.

Other successful students from the REU program include the following:

Kristine Gould, who worked on robotics and visual motion and was published in "1989 Computer Vision and Pattern Recognition"; Jay Hackett worked on multi-sensor fusion with his studies published in the "IEEE Conference on Robotics and Automation" and the "Optical Engineering" journal; Matt Lavoie received the Outstanding Research award for his thesis, presented his project to the NSF and published in one journal and one conference paper; Bill Allen published a paper in the "International Conference on Pattern Recognition" and "Pattern Recognition"; Glenn Martin presented his project in the "National Conference on Undergraduate Research"; Katharine Keiter published a paper on cyclic motion detection; and Warren Macchi published his work on interreflection with rough surface in "1994 International Conference on Pattern Recognition," and he won a three-year fellowship from the NSF for his graduate work at UCF.

REU IN THE NEWS

REU PICTRURE BOOK

Chris Ingrassia, 1997-1998

My project involved the segmentation and motion tracking of the coronary arteries from cineangiograms. My positive REU experience is the reason I decided to pursue graduate school and that particular project sparked my interest in cardiac mechanics, which has been my academic focus since graduating from UCF in 1998. In 2001, I earned an M.S. in mathematics from New York University, taking the maximum number of research credits in the field of cardiac fluid dynamics. From there, I entered the newly-started biomedical engineering program at Columbia University to pursue the Ph.D. This endeavor has taken longer than I hoped, but will mercifully come to a conclusion soon. My current focus is finite element modeling of the left ventricle. While my research has deviated from computer vision, the REU program opened my eyes to other areas that I never would have been exposed to.

My project in 2002 involved determining from video (either a side view or rear view), whether a young child is in the process of climbing. The experience at the REU was fun, challenging, sometimes frustrating, and ultimately enlightening. By the end of the summer, my research, with Dr. Lobo's counsel, did have a pay-off as my project was able to detect an infant climbing. Since graduating Swarthmore College in '03 I went on to work in IT at a small company for a few years until I decided to apply to graduate school in neuroscience. As I approach my second year I am now studying and researching at the Krasnow Institute for Advanced Studies at George Mason University.

Todd Gillette 2002-2003

Min Shin, 1995-1996

During the summer of my junior year in undergrad (1995), I had an opportunity of participating in the REU program. It started with a six-week crash course on computer vision. Then, I spent an entire year conducting a research project under one-on-one mentoring. I learned a great deal working on a challenging problem while spending time in a lab full of graduate students. I went for a graduate studies at USF getting Masters in 98 and PhD in 01. I am current an Assistant Professor at UNC-Charlotte. The REU program introduced me to the excitement of research and prepared me well for the graduate school and for my current job. In fact, I have applied the REU-like strategy for recruiting graduate students by working one-on-one with them early in their undergrad years. I am truly thankful for the opportunity and the faculty members for their exceptional mentoring.

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David Diel, 2001-2002

One great idea that I took away from the UCF REU was this: Everything that shows up in front of a camera has mechanical properties, and sometimes you want to model the motion of these objects, or the motion of the camera itself. So, I spent a few years at MIT telling people that. Then, I got a job based on my research, just outside of Boston, which I hope will keep me close enough to the academic community to complete my PhD eventually.

When I came to the program, I had no clue about academic research and by the end of the program I had learned all the ins and ins of research. The graduate students from the vision lab provided a lot of guidance on the research projects, this also gave me insight into what graduate studies are about. I think I grew my brain a lot by handling a lot of challenges from the project. I remember working late at night, sometimes even till early morning, walking from the lab to the apartment, trying to make progress just for the Friday afternoon (status report) meetings.

Jigna Bhatt 2001-2002

Merrill McKee 1999-2000

My goal was manatee recognition. Although never completed, I was automatically downloading underwater webcam pictures from the Internet and performing the software I had written to that point. I took a bottom-up approach where I was looking for edges, extending them to form regions, connecting the regions by similarity, and then using rules to detect manatees. I then went to work at Lockheed Martin Missiles and Fire Control in Orlando where I did more computer vision and image processing work. Most of the work here focused on automatic target detection, recognition, and tracking. Now I am back as a fulltime PhD student with Dr. Shah.

Under the guidance of Drs. Lobo and Shah, the REU program completely changed my future outlook from one of obtaining a Master's degree and entering the private sector to one of seeking a PhD and continuing a lifetime of research in computer vision. The program introduced me to this career option in which I discovered a far greater aptitude and enjoyment than my previous plans. My accidental meeting of Dr. Lobo and subsequent time under him and the REU program completely changed my life and I hope that others like me will have the same opportunities that I did in the future. In September, I will begin my first year as a PhD student at the University of California, Davis. There, I will continue to do research in Computer Vision, something I intend to pursue indefinitely.

Chris Schwartz 2004-2005

Looking back at my days in the REU program, I am mostly reminded of the friendly challenges, healthy competitions and wonderful experiences that I shared with my fellow REU participants. I not only gained invaluable experience from the advanced Computer Vision training, it helped me to develop my research skills and gain a competitive edge during the graduate school admissions.

Ankur Datta, 2003-2004

REU PICTURE BOOK

REU PICTRURE BOOK

Jay Hackett, 1987-1988

Connie Lee, 1991-1992

Justin Garcia, 2003

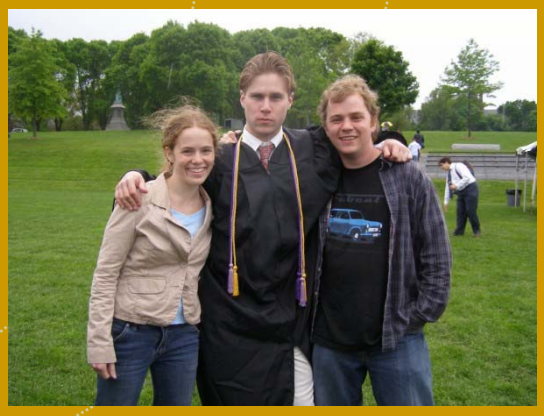
Rusty Phillips, 2000,2001

Maha Sallam, 1989-1990

Doug Ayers,1997-1998

Jim Davis, 1993-1994

Vladimir Reilly 2005-2006



Michael Sollami and friends, 2005-2006

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REU PICTURE BOOK

Bonnie Kaiser , 1990-1991

Melanie Sutton , 1990-1991

Alfred Levy, 2001-2002

Michael Wallick, 1998-1999

Glenn Martin, 1990-1991

Tamara Miller, 2000-2001

Warren Macchi, 1993-1994

2003-2004 REU

2004-2005 REU

2005-2006 REU

2006-2007 REU

2007-2008 REU

http://www.eecs.ucf.edu/~vision

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