

INFRASTRUCTURE 97-98

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Abstract

The NSF funded Center for Advanced Technology and Education (NSF-CATE) at Florida International University (FIU) was established in the Fall of 1993 for a three-year period with the objectives to address several critical technology areas, enhance our curriculum in these areas, provide a state-of-the-art computing environment which engages both educational and research venues, and to henceforth attract, retain and increase the number of students, especially in the underrepresented groups (African Americans and Women) in pursuit of their graduate students. These efforts have been complemented by an NSF Academic Research Infrastructure(ARI) grant, significant matching from our institution, and small grants from our local industry, and with a two-year renewal grant from the NSF CISE-CDA.

Introduction to Florida International University

Florida International University (FIU) is an urban doctoral-granting institution located in Miami with campuses at University Park and North Miami. Chartered by the Florida Legislature in 1965, the University opened its doors in 1972. FIU now offers more than 200 baccalaureate, master's and doctoral degree programs through its many Colleges and Schools. This year, as FIU celebrates its 25th anniversary, enrollment is currently 30,094 mark, which is a significant increase from the 16,400 enrollment a decade ago. The number of faculty has reached 1,200, and sponsored research totaled close to 30 million dollars this past year. Close to 60% of FIU's students is drawn from the minority student population, which is comprised of 46% Hispanic, 11% African-American, and 3% Asian. Women constitute, remarkably, 58% of the total student population. FIU is recognized as having the largest contingent of Hispanic students of any doctoral-granting institution. FIU currently ranks first in the total bachelor degrees issued to Hispanic engineering students and third in the total bachelor degrees issued to minority engineering students. It also ranks first in the total bachelor degrees issued to Hispanic students in computer engineering and computer science and second in the total bachelor degrees issued to Hispanic students in electrical engineering.

Introduction to the Project:

The NSF-funded Center for Advanced Technology and Education - CATE provides a computing environment capable of engaging researchers as well as facilitating classroom and laboratory-based instruction in critical technology areas such as image processing and computer vision; neural networks; distributed and parallel process; visual programming, 3-D modeling and the important issue of real-time processing. Additional funding from NSF, local industry, and significant matching from our institution allowed us to expand our research efforts into the areas of 3-D visualization and simulation, Dynamic 3-D modeling through confocal microscopy, real-time signal processing in flow cytometry, and biomedical applications related to hematology and biomedical diagnosis.

Goals, Objectives, and Targeted Activities for the Past Year

This past year, we have supported: 12 female students and 10 male students with the following ethnic make up: 14 Hispanics; 4 African Americans, and 4 White non-minority students. Of these students, 3 received MS degrees; and 8 received a BS degree this past year

Strengthening of the Networking of Research Groups

Faculty and students from electrical and computer engineering, school of computer science, mechanical engineering, industrial engineering; research partners from local industry and institutions are given access to our ONYX parallel machine where 65 computer accounts are active this year, and to the confocal microscope for 3-D viewing and analysis of different specimens. These are but few examples of how the NSF-CATE center is providing the means to bring us faculty and students from different research areas together, and creating the potential for exploring new research avenues.

Targeted Activities

Research Projects: Funded Research Spawning from the Creation of the NSF-CATE Center have led to the study of several research avenues as indicated by the title of these grants and fellowships:

Malek Adjouadi as PI or Supervisor:

National Science Foundation CISE/CDA; Integrated Sensing Towards Real-Time Vision, Cognition, and 3-D Modeling; September 1995-August 1997. Amount \$ 267,000

National Science Foundation CISE/CDA (HIMI); Multidimensional and Multispectral Information Processing and Computational Aspects; September 1996 - August 1999. Amount \$ 201,000

National Science Foundation; Research Experience for Undergraduates; September 1995-August 1997. Amount \$ 80,000

National Science Foundation - Minority Graduate Fellowship for Ms. Sonia Duranza; "Time Varying Images Using Confocal Microscopy"; September 1996 - August 1999. Amount \$ 69,000

National Science Foundation Minority Graduate Fellowship for Ms. Annette Taberner; Study of Spatio-Temporal EEG Signals Towards the Development of a Man-Machine Interface; Sept. 97-Aug. 2000. Amount \$ 69,000

Coulter Corporation; Research and Instrumentation Division; Imaging Algorithms for Enhanced Pattern Classification of Blood Cells; April 1995 - March 1997. Amount \$ 54,000

Coulter Corporation; Molecular Biology Division; The Cell Probe Project. Amount \$ 5,000

Malek Adjouadi as Co. PI: USAF-Wright Peterson Laboratory; Time Frequency Analysis and Noise Filtering of Non- Stationary Signals; May 96 - Apr. 99 [PI: Jean Andrian]. Amount \$ 210,000.

Proposals Submitted this year with the NSF-CATE center:

(1)

PI: Malek Adjouadi

Co-PIs: Armando Barreto, Julie Jacko, Ana Pasztor, Gustavo Roig, , Robert Coatie, and Maricel Gavilan.

Proposal Title: Establishment of a Comprehensive Instructional Program for Providing Excellence in Education with Increased Access and Opportunities in Areas of Critical Technology Needs.

Funding Source: US dept of Education

Amount: \$ 1,100,911

(2)

PI: Malek Adjouadi

Co-PIs: Kurt VanLehn, Armando Barreto, Julie Jacko, Ana Pasztor and Gustavo Roig

Proposal Title: “Establishment of an Integrated Infrastructure for Learning Strategies and Human-Computer Interaction: A Partnership between Florida International University and the NSF-Center for Interdisciplinary Research on Constructive Learning Environments, the NSF-CIRCLE”

Funding Source: NATIONAL SCIENCE FOUNDATION- CIRE Program

Amount: \$ 1,162,428

(3)

PI: Malek Adjouadi

Co-PIs: Armando Barreto, Julie Jacko, Ana Pasztor, Gustavo Roig,

Proposal Title: “Information Processing, Modeling and Interpretation for Human Computer Interface Research with Real-World Applications”

Funding Source: FOUNDATION- CISE Directorate, Experimental and Integrative Activities

Amount: \$ 1, 410,085

(4)

PI: Malek Adjouadi

Co-PIs: Armando Barreto, Julie Jacko, Ana Pasztor, Gustavo Roig

Proposal Title: *Educational Innovations in Engineering for an Environment that Promotes Effective Learning, Human Computer Interactions, Hardware-Software Integration and Supplemental Instruction..*

Funding Source: National Science Foundation -AASE Education Reform Program

Amount: \$ 1,245,286

(5)

PI: Malek Adjouadi

Co-PIs: Armando Barreto, Julie Jacko, Ana Pasztor, Gustavo Roig,

Proposal Title: Acquisition Of An EEG-Based Imaging System For Human-Computer Interface Research

Funding Source: National Science Foundation –MRI Program

Amount: \$ 208,750

(6)

PI: Armando Barreto

Co-PIs: Malek Adjouadi, Julie Jacko, Ana Pasztor, Gustavo Roig, **Proposal Title:** *Educational Innovations in Engineering for an Environment that Promotes Effective Learning, Human Computer Interactions, Hardware-Software Integration and Supplemental Instruction..*

Funding Source: National Science Foundation –MRI Program

Amount: \$ 333,973

Summer Programs: Some of the students supported by the NSF-CATE center participated in the following 1996 summer programs: - Annette Taberner: AT&T Operations Technology Center (OTC) Summer Internship, Middletown, New Jersey - Richard Lopez: Motorola, Software development Division, Integrated Dispatch Enhancement Network, Sunrise, Florida - Jesus Lebena: Motorola, JEDI Production Line, Detection and Causes of Defects in the JEDI two-way radio, Sunrise, Florida - Geydi Lorenzo, FP&L, Information Management, UNIX system administration, Miami, Florida

Creation of Laboratories

The following have been established since the creation of the NSF-CATE center which now integrates the computer vision laboratory. Laboratory for Confocal Microscopy - Funded by NSF CISE/CDA (ARI); and the Laboratory for Flow Cytometry - Funded by Coulter Corporation. Also, just recently, we established the

Outreach Programs

The outreach programs with the department of electrical and computer engineering (ECE) are headed by Dr. Gustavo Roig, a Co.-PI of the NSF-CATE center, but also our associate Dean for external programs. These programs are: NASA Sharp Plus, Florida/Georgia Alliance for Minority Participation (FGAMP) Summer Program; Junior Engineering Technical Society (Jets) / United, and Florida Action For Minorities in Engineering (FLAME) Program. Students from these programs visit our NSF-CATE center and we try to encourage them to join FIU and pursue a career in engineering.

New Faculty in the ECE department

We are hiring a new faculty to start this coming Fall 1998 semester in the area of Computer Engineering with expertise in optical computing and a visiting assistant professor also to start in the Fall of 1998 in the area of parallel processing.

Curriculum Development

Furthermore The following courses have been added to our curriculum in support of our Computer Engineering program which brings great academic support to students doing research in these areas with the NSF-CATE center: (1) at the graduate level: EEL 6821: Computer Vision, EEL 6990: High-Speed Tele-Networks, and EEL 6993: Ultrasonic Imaging, EEL 6812: Advances in Neural Network, and EEL XXXX: Real-time DSP; (2) at the undergraduate level: EEL 2993: Applied Software techniques in Engineering.

Component and Materials Required

The Human Capital

The people involved with the NSF-CATE this past year include:

Staff: Director: Malek Adjouadi; Manager: Noemi Fernandez; Support Staff: Pat Brammer, Sonia Duranza and Patricio Vidal;

Faculty: Armando Barreto, James Story, Gustavo Roig, Wunnava Subbarao, Ana Pasztor, Naphtali Rische, and Jean Andrian.

Graduates Student Support: Nydia Ruiz, Elise Jackubjick, Mildred Saenz, John Riley, Patricio Vidal, Carlos Reyes, Chris Godefroy, Peter John Hugh, Gulio Blandon

NSF-Graduate Fellows: Sonia Duranza, Annette Taberner, and Erica Suarez.

Undergraduates Student Support: Geydi Lorenzo, Ralph Buigas, Susan Danner, Erica Suarez, Marco Midon, Nydia Ruiz, Marlin Brinson, Dorian Hernandez, Richard Lopez, Meika Webster, Maybelline Rivas, Luu Phuong.

Meika Webster Research experience involved:

- Automatic robot navigation using sonar and infrared data. - Graphic visualization. - C++ programming and - Unix platform.

Maybelline Rivas Research experience involved:

- Video compression. - Digital data transmission in computer networks. - MatLab programming.- C++ programming. And - Unix platform.

Luu Phuong Research experience involved:

- 3D modeling - VRML (Virtual Reality Modeling Language) programming. - Unix platform.

Erica Suarez and Richard Lopez as a team Research experience involved:

- The design of circuit to simulate the functioning of an alarm-protected home include all types of security measure and timing issues.

The Physical Capital

The Onyx Machine with four R-8000 processors; An RCM 8000 real-time Confocal Microscope; A Nomad 200 is an integrated mobile robot system; A Coulter EPICS Profile II Flow Cytometer; 20 SGI Indy Workstations; 1 Challenge M server; Studio set-up for 3-D Visualization ; and 12 Personnel Computers (5 of which are Pentium 200Mhz-based with MMX Technology); and accessories including 2 Printers and CCD cameras. Our institution this year provided matching funds totaling more than \$ 100,000 on equipment: \$ 75,000 from FIU's Division for Sponsored Research and Training; \$ 18, 000 from the Dean's Office, and \$7,000 from the ECE department); Student support \$14, 729 from the Dean's office. Next year we are to honor \$170,000 of matching funds. These matching funds do not include any release time.

Indications of Success

Description of the Infrastructure Developed

The NSF-CATE center with its ONYX supercomputer and the networked SGI systems constitutes an infrastructure that is viable for cutting-edge research activities providing an environment that facilitates state-of-the-art educational and research activities. Since our move to a newer and larger facility, a more efficient reconfiguration of the CATE Local Area Network was set-up for the newly purchased Engineering and Applied Sciences Building. This infrastructure thus provides an environment for: (a) software development under both parallel and distributed processing platforms, (b) high performance 3-D rendering and modeling of static as well as dynamic events, (c) real-time processing capability, (d) operating systems and graphics software that meet current standards, and (e) high-speed data acquisition, playback, analysis, and communications links. Additional funding from NSF and local industry allowed to acquire a confocal microscope, and a flow cytometer which are allowing us to branch out in the areas of biomedical engineering involving the fields of hematology and biomedical diagnosis.

Students Support

The following statistics show the number of degrees conferred to the students directly supported by the NSF grant so far: 1 Ph.D. student (a female Hispanic), 12 Master students (7 Male Hispanics, 1 Male African American, 2 Female Hispanics, 1 Male White, and 1 Male Asian), and 8 BS students (5 female Hispanics, and 2 African Americans one of whom is blind person. We have in the pipeline the following students: 6 Ph.D. Students including 2 Female Hispanics and 2 Male Hispanics; 12 Students have so far obtained their MS. Degree with the direct help of the NSF-CATE center which include 3 female Hispanics, 6 male Hispanics, and one African American, and one Asian; 7 masters students in the pipeline including 5 female Hispanics and 1 male Hispanic; 7 Female Undergraduates (including 5 Hispanics, and 1 African American) and 7 male undergraduates (with 3 African American and 4 Hispanics) supported through the NSF-REU Grants, and 8 BS degrees conferred to students supported through the NSF-REU (with 5 female Hispanics, 2 African Americans), one of these graduates is a blind person. These Supported this

past year include: 3 MS theses which were directly supported, and 3 others were supported indirectly through the use of the NSF-CATE facility. Also, 22 publications this year recognize the support of NSF.

Unmet Goals

We had hoped that our impact on attracting African American students would be more significant. We do take solace however in the fact that the cited FLAME and FGAMP programs are placing several African Americans students in other institution of higher learning such as Georgia Tech., UF, Penn State, Howard University and others.

Outcome

The most significant contribution this project made is in the attraction and support of 11 female students out of the total 83 female students (undergraduate and graduate) in the department of electrical and computer engineering. The success here is total (100%), that is either these female students went on to the graduate program or went on to high-paying jobs with local and national industry. The number of female graduate students supported by the CATE center constitute this year 50 % of all the female graduate students in the ECE department. Two of these female students are recipients of the prestigious NSF minority graduate fellowships.

New research concepts become possible with the advent of this infrastructure. For example we did not expect to branch out in the biomedical field with respect to diagnosis and hematology studies. Also, with the acquisition of the confocal microscope, we now have the potential to perform dynamic 3-D image visualization, modeling, and analysis. The ONYX parallel machine has allowed us to research the issue of real-time processing. In terms of educational techniques, the NSF-CATE infrastructure all of its users to put theory to practice, whether in imaging technology, robotics, or any form of software development. This is an important aspect which allows undergraduates to become fascinated by such technological breakthroughs and thus become attracted to go on with their graduate studies.

Impact

Major consequences since the advent of the NSF-CATE center include: The collaboration with SGI with the prospect of creating an SGI/FIU Technology Research Center funded at 4 Million dollars with 2M from SGI and 2M from the State University System. The collaboration with Coulter and Baptist to create a biomedical engineering program within the college of engineering. This involves submitting a proposal to Whitaker. The FIU membership application in the Internet2 organization, and we are now working on several initiatives to fund our connection to this important new instruction and research support facility. The first of these initiatives involves partnering with the NSF, BOR, and other members of the SUS Florida gigaPoP which include: UF, FSU, UCF, USF, FAU, FAMU, and FIU).

Publications

1. F. Candocia and M. Adjouadi, "Stereo Feature Matching Using a New Similarity Measure", **IEEE Transactions on Image Processing**, Vol. 6, No. 10, pp. 1460-1464, October 1997.

2. C. Reyes, and M. Adjouadi "A Directional Clustering Technique for Random Data Classification", **Cytometry**, Vol. 27, No. 1, January 1997.
3. A. M. Taberner and A. B. Barreto "Real-Time Signal Processing Towards an EEG-Based Human-Computer Interface", Florida Conf. on Recent Advances in Robotics. Miami, Florida, Apr. 1997.
4. N. Fernandez and M. Adjouadi, "An Orientation-Independent Imaging Technique for the Recognition and Classification of Objects", Florida Conf. on Recent Advances in Robotics. Miami, Florida, Apr. 1997.
5. M. Adjouadi and F. Candocia "Pattern Matching for Object Recognition and Depth Reconstruction", Florida Conference on Recent Advances in Robotics, Miami, Florida April 1997.
6. N. Fernandez and M. Adjouadi, "An Orientation-Independent Imaging Technique for the Recognition and Classification of Objects", 1997 Florida Conference on Recent Advances in Robotics, Miami, Florida, April 10-11 1997.
7. A. B. Barreto, C.D. Aguilar, and E. Jackubzick "Adaptive LMS Delay Measurement in Dual Blood Volume Pulse Signals for Non-Evasive Monitoring". 16th Southern Biomedical Engineering Conference, Biloxi, Mississippi, April 1997.