

Carlos Torres, PhD - Curriculum Vitae

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PROFESSIONAL PROFILE

I am a driven computer vision and machine learning researcher with 11 years' experience planning, managing, and executing technologically complex and ambitious projects ranging from small-object detection, multiple object tracking, and image classification to complex behavior representation and analysis, edge computing, multimodal systems. My academic credentials include a Doctor's of Philosophy (Ph.D.) degree from the University of California Santa Barbara (UCSB) in the department of Electrical and Computer Engineering (ECE). During my tenure at UCSB, I taught undergraduate, senior level classes, drafted and received research grants, worked as a Software Developer, Chief Data Scientist in the insurance industry and Staff Data Scientist / Machine Learning Researcher in the construction / project management software industry. My Ph.D. thesis combines multimodal time-series data – from inexpensive multimodal distributed sensor networks – with healthcare. The objective of my thesis is to develop robust computer vision and machine learning techniques and analysis algorithms to support the development and evaluation of patient-centric therapies and practices. The rest of my academic credentials include a Master's of Science (M.S.) in ECE from UCSB focused in Signal Processing, Machine Intelligence, and Controls Systems and a dual Bachelor's of Science (B.S.) degree from San Jose State University (SJSU) in Electrical Engineering and Bioengineering with minors in biochemistry, chemistry, math, and physics. As an undergrad studies, I participated in research and internship programs in biochemistry at SJSU, electrical engineering at Hewlett-Packard Labs, and robotics at the Georgia Institute of Technology.

In addition to academics, my post graduate industry credentials include four years of data sciences, machine learning, and computer vision experience in the following roles: 1) *Principal Investigator and Senior Research Staff Member* in the aerospace and defense sector, developing activity analysis algorithms using single shot detectors, few samples, and relational information for aerial overhead imagery and designing methods to derive uncertainty estimates in graphical neural networks for object detectors and activity representation and analysis. 2) *Staff Data Scientist and Machine Learning Researcher* in the construction management industry, building models to classify and forecast processes, analyze and profile unstructured text, optimize existing services, and perform cohort and churn analyses; 3) *Chief Data Scientist* designing, developing, and deploying solutions that use web-footprint data for insurance applications; and 4) *Software Engineer* developing fast and robust virtual-reality collaboration systems. My academic and industry research projects have been awarded contracts and produced robust deployable applications and various peer-reviewed technical conference and journal publications.

My areas of expertise and interests include Computer Vision, Data Sciences, Deep Learning, Machine Learning, Sensor Networks, Natural Language Processing, and Statistical Analysis. Some relevant courses taken at UCSB include "Fundamentals of Speech Recognition" taught by Prof. Lawrence Rabiner, which covered time-series statistical analysis via Hidden Markov Models (HMMs), Viterbi and Baum-Welch, algorithms, dynamic programming, Bayesian classifiers, and Artificial Neural Networks (ANNs). Computer Vision courses include "Introduction to Computer Vision", "Advanced Topics in Computer Vision", and "Advanced Topics in Image and Video Processing" taught by Prof. B. S. Manjunath. These courses were project-based courses that focused in advanced techniques such as Scale Invariant Feature Transform (SIFT), face detection and matching (Eigenvalues for Eigenfaces), object recognition (Bag of Words), optic-flow (Lucas-Kanade), wavelets, and signal compression (Haar and JPEG). Control and perception courses include "Robotic Navigation" and "Distributed Controls of the Robotics Networks", both taught by Prof. Francesco Bullo, which covered sensor-based motion planning algorithms, complexity analysis, collision detection and avoidance, and algorithms such as Breath First Search (BFS), Rapidly-Exploring Random Trees (RRTs), and Probabilistic Random Maps (PRMs).

RESEARCH INTERESTS

My early research focused on the integration of multimodal sensor networks (e.g., rgb & depth cameras, thermography, pressure arrays, etc.), computer vision, and machine learning algorithms with the health sciences to address non-existent individualized healthcare analysis and care demands. I am particularly interested in designing methods to collect and process objective clinical data, which is essential to the development of patient-centric therapies and treatments. The integration of such scientific and engineering elements will make possible to unobtrusively treat, monitor, and analyze patients.

Currently, my research efforts focus on view independent small-pixel footprint object detection, tracking, and reidentification (short and long term). I am also interested in the representation and detection of complex activity and event analysis. In particular, I am interested in the application of these technologies to extreme event (street accidents, natural disasters, etc.) analysis, preparedness, and response; autonomous navigation (safety and collision avoidance; smart environment (healthcare and senior independent living); and community safety and surveillance (loss prevention and urban planning). In addition, I am currently exploring multimodal methods for sentiment evolution analysis for latent risk estimation applied to current global events.

Long-term my interests are in the development of autonomous systems (software and hardware) that are adaptively aware of their surroundings (context and environments). Examples of such systems include robots, smart environments, and mobile devices, which are ubiquitous computers with untapped potentials. Concretely, my technical research interests are focused in the development of hardware and software solutions that enable autonomous systems to navigate and execute complex tasks in natural human environments.

PRESS COVERAGE

- *The ECE Current - UC Santa Barbara Fall 2017*
Multimodal Eye-CU Sensor Network for Healthcare: [MESH](#).
- *The ECE Graduate Student Spotlight - UC Santa Barbara Spring 2013*
Computational Healthcare: Medical Internet-Of-Things. ([RETIRED LINK](#)).

EDUCATION

- **University of California Santa Barbara** Santa Barbara, CA
Ph.D. in Electrical Engineering: Computer Vision and Machine Learning 2012 – 2017
 - Advisor: B. S. Manjunath, Ph.D.
 - Proposed Thesis Title: Multimodal Analytics for Healthcare.
 - Press coverage of [MESH](#)
 - Completed 2017: Healthcare activity and event analysis and logging via contextual aspects (role, location, duration, and interactions).
 - Completed 2017: Role representation and identification from semantic interaction maps.
 - Completed 2016: Analysis of multimodal multiview pose patterns. Integration of time information. Identification of the duration and transitions of poses.
 - Completed 2016: Multimodal multiview pose classification of bed-ridden patients. Devised a new method to estimate trust, which improved performance and robustness.

- Completed 2015: Multimodal human body pose classification of bed-ridden patients. Provide a non-obtrusive platform to analyze patient sleep poses via modality trust.
- Completed 2014: Sensor evaluation and network integration for healthcare. This includes remote sensors, thermal imaging, and 3-D point clouds (e.g., RGB-D and Thermography)

- **University of California Santa Barbara** Santa Barbara, CA
Master's of Science in Electrical and Computer Engineering 2009 – 2012
 - Advisor: B. S. Manjunath, Ph.D.
 - Concentrations: Signal Processing, Machine Intelligence, and Control Systems
 - Signal Processing relevant courses: Introduction and Advanced Topics in Image Processing, Introduction and Advanced Topics in Computer Vision, Matrix and Computation Analysis, Embedded Systems Design (Android O.S.), and Digital Signal Processing (single & multi-rate)
 - Machine Learning relevant courses: Digital Speech & Fundamentals of Speech Processing
 - Controls relevant courses: Distributed Controls of the Robotic Networks, Linear System Theory (SISO and MIMO), Game Theory, and Robot Mechanics (path planning algorithms)
- **San Jose State University** San Jose, CA
Bachelor's of Science in Electrical Engineering (EE) and Bioengineering (BE) 2004 – 2009
 - Advisor: Robert Morelos-Zaragoza, Ph.D.
 - Major Concentration: Digital and Analog Circuit Design and Signal Processing
 - Project: Wireless Interface for Musical Instruments
 - Minor Concentrations: Bioengineering, Mathematics, and Physics
 - EE courses: Radio Frequency Identification (RFID), Design with Field Programmable Gate Arrays (FPGAs), Digital Filter Design, and Design with Operational Amplifiers
 - BE courses: Biomechanics, Physiology, Organic Chemistry, and Molecular Biology

RESEARCH & WORK EXPERIENCE

- **Principal Investigator and Sr. Researcher** Mayachitra Inc., Santa Barbara, CA
Mayachitra's Site ([website](#)) Aug 2018 – Present
 - In my role as Principal Investigator (PI) and Senior Research Staff Member. I design highly accurate systems and algorithms for various defense, military, and intelligence agencies by combining classical machine learning and computer vision methods with the latest developments in artificial neural nets and deep learning. During my tenure at (MC) I served as Principal Investigator for the National Geospatial-Intelligence Agency (NGA) Phase *I* project: “Deriving uncertainty estimates for automated observations of objects from aerial imagery” and Phase *II* project: “Improving Aggregation and Activity Analysis in Overhead Imagery using Uncertainty Measures”; Office of Naval Research (ONR) Phase *I* project: “Multimodal Sentiment-Evolution Analysis for Latent-Risk Estimation”; and authored award-winning grants to the U.S. Air-Force (AF), Army (A), Office of Naval Research (ONR), National Science Foundation (NSF), and National Institutes of Health (NIH) and Rapid Innovation Fund (RIF) proposals to the DoD.
- **Post-Doctoral Researcher / Specialist** University of California Santa Barbara, CA
Mayachitra's Site ([website](#)) Sep 2018 – Oct 2019
 - In this role, I mentor Master and Doctoral level students in computer vision and deep learning research projects. My efforts focus on: (1) methane plume detection and estimation using very-large area hyperspectral data and deep learning techniques and (2) atomic behavior analysis on weakly labeled datasets (AVA) via Actor Centered Activation Maps (ACAMs).

- **Sr. Lead Data Scientist: Machine Learning** Procore Technologies, Carpinteria, CA
Procure's Site ([website](#)) Nov 2016 – Aug 2018

 - In my role as Data Scientist and Machine Learning Investigator, I develop and implement statistical methods and models to classify and estimate outcomes regarding timeliness and quality of various procedures essential to the construction industry. Also, I explore, design, implement, and deploy machine learning solutions for internal use, for example, time-series analysis to model performance and identify areas in need of improvement, churn models, and account data correlations. During my time with Procure, I submitted two manuscripts to a top conference and drafted patent applications. With support from coworkers, I deployed one new timeliness and response estimation service. I used natural language processing (NLP) and machine learning to improve an existing document management service (technical documents and blueprint drawings). Finally, I devised a method for cohort analysis and account health estimation based on usage seasonal trends and gains.

- **Chief Data Scientist** Carpe Data (Formerly Social Intelligence), Santa Barbara, CA
Carpe's Site ([website](#)) Nov 2015 – Oct 2016

 - In my role as Lead Data Scientist, I developed and implemented statistical methods to analyze web-footprint data. Web-footprint data is extremely noisy, unstructured, and contains high levels of uncertainty. The data includes social media profiles (e.g., Facebook, Twitter, Youtube, G+, Gmail, Hotmail, etc.) and their respective contents (text, keywords, and word frequencies). I used features extracted from data attributes to estimate insurance risk levels. I investigated methods to mine and quantify web content (sentiment, ownership, and presence) using Natural Language Processing (NLP), Machine Learning, and Artificial Neural Networks. I used statistical analysis and cloud technology to swiftly disrupt the outdated insurance and credit technologies, where Carpe Data expects to become the next generation data provider.

- **Researcher & Software Developer** Caugmate, Santa Barbara, CA
Caugmate's Site ([website](#)) – acquired by Vuforia Sep 2015 – Nov 2015

 - As a developer and researcher for the start-up, Caugmate, I developed, implemented, and optimized algorithms for real-time performance. The objective is to create a 3D collaboration ecosystem by combining Augmented Reality with mobile computing technologies.

- **Graduate Research Assistant** University of California Santa Barbara, Santa Barbara, CA
Vision Research Laboratory ([website](#)) Aug 2010 – Sep 2015

 - As a graduate student and member of the Vision Research Laboratory (VRL) in the Electrical and Computer Engineering (ECE) department under the supervision of Professor B. S. Manjunath, I explore areas in Computer Vision related to multimodal sensor processing and algorithms. Current projects and interest include design and deployment of multimodal sensor networks for affordable monitoring of healthcare facilities. Research collaborations include designing a mock-up ICU (MICU) room and monitoring two rooms in the Intensive Care Unit (ICU) at the Santa Barbara Cottage Hospital. The MICU infrastructure serves to mimic patient conditions and ICU environment. In particular, it enables the continuous evaluation of sensors and analysis algorithms without disrupting patients or medical standards of care. My general responsibilities include continuous literature search to identify computer vision research opportunities. My Doctorate thesis scope includes human pose estimation, multimodal data fusion and modeling, and multimodal human action, activity, and event (HAAE) analysis. Initial findings and potential impact and benefits of this work were presented at ICVS 2015, WACV 2016, ECCV 2016, ICDS 2017 and were well received by my peers.

- Research Assistant** San Jose State University, San Jose, CA
 • *Eggers' Laboratory ([website](#))* *Aug 2007 – Sep 2009*

 - While being supported by the National Institutes of Health (NIH) Minority Access to Research Careers (MARC) program, I worked and received training under the mentoring and supervision of Dr. Daryl K. Eggers in a Biochemistry laboratory. In the Eggers lab, I designed experiments and analyzed data results for water and surface effects on protein folding. The experiments performed in the lab included Sol-Gel glass encapsulation and adsorption of modified TMOS glasses. The analysis of samples was based on circular dichroism (CD) and UV spectrometers techniques for assessing protein structure in and out of the test-glasses as well as the test-glass adsorption. Significant results of this continuing research have been published in Biophysics, and the latest results have been presented at multiple conferences. In addition, preliminary results led to the expansion of this research to other organic modifiers with support from the National Science Foundation (NSF). Follow up experiments focused on exploring the sol-gel properties of biocompatibility for protein encapsulation and analysis which were also published in a peer-reviewed journal.

- Summer Research Assistant** Georgia Institute of Technology, Atlanta, GA
 • *Healthcare Robotics Laboratory ([website](#))* *May 2008 – July 2008*

 - As a participant in the Summer Undergraduate Research Experience (SURE) program at the Georgia Institute of Technology, I worked under the supervision of Dr. Charles C. Kemp, Professor at the Biomedical Engineering Department and Principal Investigator at the Healthcare Robotics Laboratory (HRL). As a summer researcher, I designed and executed experimental protocols to test machine learning algorithms and sensor response for the customized-laboratory-robot El-E. This project required the exploration of robotic grasping and placing of objects on flat surfaces using haptic feedback. The software specifications included Linux/Ubuntu and Python to control a Katana Arm by Neuronics and ATI Force and Torque (FT) sensors. The overall objective of the HRL group is to design autonomous systems capable of executing tasks in human environments and to improve the quality of life of motor-impaired patients by developing assistive robots. A second project required the design of an RF system and interface to optimize power and data acquisition. Results of this investigation were presented at the NIH Annual Biomedical Research Conference for Minority Students (ABRCMS Fall 2008).

- Research Assistant** Hewlett-Packard Laboratories, Palo Alto, CA
 • *Optical Systems Technology (OST)* *May 2007 – Aug 2007*

 - As a summer intern and under the supervision of Dr. Carl Taussig (e-ink and Amazon 128Labs) and the mentoring of Dr. Warren Jackson in the Large Inexpensive Flexible Electronics (LIFE) team, I rebuilt and redesigned a control system for testing strain failure of flexible semiconductors. Testing of samples was performed via a custom automated system for evaluating performance of electrical devices on plastic substrates. I developed experimental procedures for measuring the effects of mechanical strain on the electrical continuity and line-to-line isolation substrates. The control and data collection processes were implemented in LabView. Also, I analyzed breakdown voltage versus area data trends of flexible semiconductor devices using MATLAB. The results of my investigation helped to improve the fabrication procedures to maximize device reliability and manufacturing yield.

- Intern** Hewlett-Packard, Boise, ID
 • *Color Laser Jet R&D* *Jun 2006 – Aug 2006*

 - Successfully designed and programmed "FAST SPI BOARD" for internal development (ASIC design group). I actively researched and implemented new technologies including software and hardware innovations to meet customer specifications. I had complete ownership of the

project, which required parts to be carefully procured to meet the scheduled delivery. The testing and programming of the FAST SPI prototype was done in Verilog using Xilinx 8.1i. Some 2006 state-of-the-art hardware highlights include a customized PBC design, debug, and prototype, Spartan II FPGA, and PSRAM memory devices.

AWARDS, GRANTS & HONORS

- **US-Navy: Office of Naval Research (ONR)** Mayachitra, Inc.,
Small Business Innovation Research (SBIR) Phase I *Oct 201 – Sep 2020*
 - Principal Investigator & Author: Multimodal Sentiment-Evolution Analysis for Latent-Risk Estimation.
 - Topic: AI-Based Trend and Sentiment Analytics for Latent-Risk Discovery.

- **US-National Geospatial-Intelligence Agency (NGA)** Mayachitra, Inc.,
Small Business Innovation Research (SBIR) Phase II *Pending Decision*
 - Principal Investigator & Author: Improving Aggregation and Activity Analysis in Overhead Imagery using Uncertainty Measures.
 - Topic: Deriving Uncertainty Estimates For Automated Observations in Overhead Imagery.

- **US-National Geospatial-Intelligence Agency** Mayachitra, Inc.,
Small Business Innovation Research (SBIR) Phase I *Sep 2015 – June 2019*
 - Principal Investigator: Improving Uncertainty Estimates in Neural Graphical Models.
 - Topic: Deriving Uncertainty Estimates For Automated Observations in Overhead Imagery.

- **US-ARMY Grant Awarded** University of California, Santa Barbara
Institute of Collaborative Biotechnologies (ICB) *Dec 2012 – May 2015*
 - Author: Multimodal Sensor Network – A Systems Approach to Analyzing Patient Well-Being and Disease States.
 - PIs: B. S. Manjunath and Scott D. Hammond

- **Outstanding Teaching Assistant Award** University of California, Santa Barbara
Electrical and Computer Engineering Department *Sep 2011 – May 2012*

- **National Science Foundation (NSF)** University of California, Santa Barbara
LSAMP-BD Fellowship *Sep 2009 – Sep 2011*

- **Dean of Engineering Award** San Jose State University
College of Engineering *May 2008 – Aug 2009*

- **National Institutes of Health (NIH)** San Jose State University
Maximizing Access to Research Careers (MARC) Fellowship *May 2007 – May 2009*

- **University President's List** San Jose State University
Ranked in the top 5% *Sep 2005 – May 2008*

- **Hewlett Packard (HP) Scholarship** San Jose State University
Electrical Engineering Department *June 2004 – Jan 2008*

MENTORING

- **Complex Behavior Analysis** Mayachitra, Inc.,
Summer 2019
Research Mentor: Electrical Engineering PhD Student
 - Mentored an Electrical Engineering PhD student in Computer Vision and activity analysis techniques. Introduced the OpenCV, PyTorch, and Scikit-Learn Python libraries using agile methodologies applied to research. The project objectives included developing efficient methods for object-interaction representation that require small number of samples. Findings from this work were submitted to a peer-reviewed conference and are currently under review.
- **Robust Object Representation & Reidentification** Mayachitra, Inc.,
Spring-Summer 2019
Research Mentor: Electrical Engineering MS Student
 - Mentored an Electrical Engineering MS student in Computer Vision, Machine Learning, and Deep Learning. Introduced the OpenCV, PyTorch, and Scikit-Learn Python libraries. The project objectives included developing efficient methods for object detection, identification, representation, and reidentification through natural scenarios and extreme events (i.e., natural disasters). The methods for short- and long-term applications rely on the effective combination of filtering and matching algorithms. The representations are based on global and local features extracted using conventional computer vision and deep neural network techniques. Findings from this work will be submitted to a top peer-reviewed conference.
- **Smart Sensor Networks** University of California, Santa Barbara
Spring-Summer 2017
Research Mentor: Electrical Engineering Student
 - Mentored a Senior Electrical Engineering student in Computer Vision and activity analysis techniques. Introduced the OpenCV, OpenNI, and Seeklib libraries and Python binaries. In addition, I facilitated the testbed Raspberry Pi3 B+ to interact with the Primesense's Carmine and SeekThermal sensors for data collection and analysis. The set project goals included developing an autonomous and distributed sensor network system for data collection and analysis; devising algorithms to detect and track human bodies and analyze complex human activities and events; and designing and executing experiments to verify and validate findings. The student was supported by the Vision Research Laboratory under the advisement of Professor B. S. Manjunath. Findings from this work are being reviewed for publication.
- **Senior Capstone Project – Machine Learning** Procore Technologies
Winter-Spring 2017
Research Mentor: Computer Sciences Students
 - Mentored a group of Senior Computer Sciences students from the University of California Santa Barbara. My responsibilities included defining project goals and deliverable; exploring various problems in *construction management* and brainstorming potential solutions with the students; introducing machine learning tools; and designing and evaluation prototypes and candidate solutions. The challenges included unstructured and missing data, scalability, security, and deployment. The main tools introduced to the team included Python language and Pandas, SQL, and Scikit-Learn libraries. The students successfully completed their project, presented their findings, and demoed their prototype.
- **Computer Vision** University of California, Santa Barbara
Summer-Winter 2013
Research Mentor: Computer Engineering Student
 - Mentored a Junior Computer Engineering student/intern in Computer Vision and Embedded Systems programming techniques and implementation algorithms. Introduced Ubuntu operating system and computer vision OpenCV and point-cloud OpenNI libraries. In addition, I facilitated and helped with setting up a on-board testbed Panda and Beagle Boards to interact with the Microsoft's Kinect and Primesense's Carmine sensors to autonomously detect

and track human bodies. The intern was supported by the Institute of Collaborative Biotechnologies (ICB) under the seed grant "Multimodal Sensor Network: A Systems Approach to Analyzing Patient Well-Being and Disease States".

- **Robotics and Computer Vision** University of California, Santa Barbara
Research Mentor: Engineering Academy Students Summer 2012
 - Mentored two high school students in the basic design of programming algorithms. Introduced the ROS operating system, the computer vision OpenCV library, and the Python programming language and interface. In addition, I facilitated and helped with setting up a robotic testbed "turtlebot" that uses the multi-modal Microsoft's Kinect sensor and the iRobot's Roomba Create to autonomously detect and track objects, recognize gestures, and detect and match faces. The high school intern program was supported by the Institute of Collaborative Biotechnologies (ICB) under the "First Robotics Competition" project.
- **Computer Vision Mentor** University of California, Santa Barbara
Research Mentor: Undergraduate Research Program Summer 2011
 - Under the National Science Foundation (NSF) sponsored summer undergraduate research program, I served as a research mentor for a Computer Science undergraduate student from California State University, San Bernardino. The summer project included the acquisition and analysis of human-gaze search patterns. Data was analyzed using MATLAB and OpenCV and the results were presented at the undergraduate INSET symposium.

TEACHING

- **Introduction to Programming** University of California, Santa Barbara
Teaching Assistant for Professor Jeffrey Moehlis Fall 2012
 - In this introductory to programming class, for incoming freshmen students, I was responsible for preparing weekly discussions, demos, and tutorials for +60 students. The topics ranged from basic loops (for and while) to matrix operations and ordinary differential equations. I created interactive presentations in Google sites with examples and exercises that complemented the lectures and described how to use MATLAB to complete class assignments.
- **Multimedia Systems** University of California, Santa Barbara
Teaching Assistant for Professor Peter M. Melliar-Smith Spring 2012
 - As teaching assistant for the Multimedia Systems class, I was responsible for preparing demos and tutorials for +70 students. The topics ranged from video editing to 3D rendering and animation. I created didactic materials that introduce students to the use of simple video editing tools and 3D-rendering and animation packages (e.g., Blender and Art of Illusion). Also, I was responsible for specifying project requirements and grading criteria.
- **Introduction to Computer Vision** University of California, Santa Barbara
Teaching Assistant for Professor B.S. Manjunath Winter 2012
 - My teaching assistant responsibilities included preparing weekly discussion sessions, preparing software modules (MATLAB's Signal and Image Processing Toolboxes and OpenCV), holding weekly office hours, and helping student with programming assignments and preparing for exams. Furthermore, I was responsible for designing and grading testing materials and programming assignments, and reporting scores. The programming assignments covered topics in basic techniques for keypoint detection, image pyramids, feature descriptors, camera models, matching, homography and registration, and random sample and consensus (RANSAC).
- **Introduction to Image Processing** University of California, Santa Barbara
Teaching Assistant for Professor B.S. Manjunath Fall 2011

- As teaching assistant for an introductory course in digital video and image processing, I was responsible for preparing weekly discussion sessions for 50 students. The topics covered programming assignments using MATLAB's Signal and Image Processing Toolboxes and OpenCV. I held weekly office hours, where I answered students questions, revisited class topics, and addressed complex class topics. Also, I was responsible for designing and grading testing materials and assignments and reporting student scores.

- **Introduction to Robotics**

University of California, Santa Barbara

- *Teaching Assistant for Professor Francesco Bullo*

Spring 2011

- My teaching assistant responsibilities for the class ME170A / ECE181A Introduction to Robotics mainly included grading weekly assignments, projects, and exams. I maintained a database of student grades. In addition, I created exercises and programming assignments with solutions for the class and a textbook manuscript in LaTeX.

COMMUNITY OUTREACH & PARTICIPATION

- **Technical Reviewer**

1. IEEE-CVF's Conference on Computer Vision and Pattern Recognition [[CVPR20](#)].
Seattle, WA. June 13-19, 2020.
2. IEEE-PAMITC's Winter Conference on Applications of Computer Vision [[WACV20](#)].
Snowmass Village, CO. March 2-5, 2020.
3. IEEE-PAMITC's Winter Conference on Applications of Computer Vision [[WACV19](#)].
Waikoloa Village, Hawaii. January 7-11, 2019.
4. ACM's Intelligent User Interfaces [[IUI17](#)].
Limassol, Cyprus. March 13-16, 2017.
5. IEEE-PAMITC's Winter Conference on Applications of Computer Vision [[WACV16](#)].
Santa Rosa, CA. March 27-29, 2016.
6. ACM's Intelligent User Interfaces [[IUI16](#)].
Sonoma, California. March 7-10, 2016.

- **Professional Organizations**

1. SACNAS - Student Member.
2. IEEE - Professional Member.
3. CVF - Professional Member.
4. ACM - Professional Member.
5. SOLES / SHAPE - Student Member.

PUBLICATIONS

- **JOURNALS**

1. **Carlos Torres**, Jeffrey C. Fried, and B. S. Manjunath. *Healthcare Event and Activity Logging* In IEEE / EMBS Transactions of the Journal of Translational Engineering in Health and Medicine (JTEHM). Advanced Internet of Things in a Personalized Healthcare System: Validation, Analysis and Utilization. July 2018. [[pdf](#)]

2. **Carlos Torres**, Kenneth Rose, Jeffrey C. Fried, and B. S. Manjunath. *A Multiview Multimodal System for Monitoring Patient Sleep*. In IEEE Trans. on Multimedia. Emerging Areas: Healthcare. April 2018. [\[pdf\]](#)
3. Phillip J. Calabretta, Mitchell C. Chancellor, **Carlos Torres**, Gary R. Abel, Jr., Clayton Niehaus, Nathan J. Birtwhistle, Nada M. Khouderchah, Genet H. Zemedede, and Daryl K. Eggers. *Silica as a Matrix for Encapsulating Proteins: Surface Effects on Protein Structure Assessed by Circular Dichroism Spectroscopy*. Journal of Functional Biomaterials, 2012. [\[pdf\]](#)
4. Bouzid Menna, **Carlos Torres**, Mar Herrero, Vicente Rives, Aaron R. Gilbert, and Daryl K. Eggers. *Protein Adsorption onto Organically Modified Silica Glass Leads to a Different Structure than Sol-Gel Encapsulation*. Biophysical Journal, 2008. [\[pdf\]](#)

• CONFERENCES

1. **Carlos Torres**, Tejaswi Nanjundaswamy, and Shivkumar Chandrasekaran. *Uncertainty and Robustness Estimation Methods for Graphical Neural Networks: Understanding Architecture Performance*. Under review [\[preprint\]](#)
2. **Carlos Torres**, Satish Kumar, Oytun Ulutan, Alana Ayasse, Robert Dar, and B. S. Manjunath. *Deep Remote Sensing Methods for Methane Detection in Overhead Hyperspectral Imagery*. In IEEE Winter Conference on Applications of Computer Vision (WACV). Aspen, Colorado. March 2-5, 2020. [\[pdf\]](#)
3. Oytun Ulutan, **Carlos Torres**, and B. S. Manjunath. *ACAM: Actor Conditioned Attention Maps for Video Action Detection*. In IEEE Winter Conference on Applications of Computer Vision (WACV). Aspen, Colorado. March 2-5, 2020. [\[pdf\]](#)
4. **Carlos Torres**, Archith J. Bency, Jeffrey C. Fried, and B. S. Manjunath. *RAM: Role Representation and Identification from combined Appearance and Activity Maps*. In IEEE / ACM Proceedings of the International Conference on Distributed Smart Cameras (ICDSC). Stanford, California. September 2017. [\[pdf\]](#)
5. **Carlos Torres**, Jeffrey C. Fried, Kenneth Rose, and B. S. Manjunath. *Deep Eye-CU (DECU): Summarization of Patient Motion in the ICU*. In IEEE European Conference in Computer Vision (ECCV). Amsterdam, The Netherlands, October 9, 2016. [\[pdf\]](#)
6. **Carlos Torres**, Victor Fragoso, Scott D. Hammond, Jeffrey C. Fried, and B. S. Manjunath. *Eye-CU: Sleep Pose Classification for Healthcare using Multimodal Multiview Data*. In IEEE Proceedings of the Winter Conference on Applications of Computer Vision (WACV). Lake Placid, NY, USA. March 7-9, 2016. [\[pdf\]](#)
7. **Carlos Torres**, Scott D. Hammond, Jeffrey C. Fried, and B. S. Manjunath. *Sleep Pose Recognition in an ICU From Multimodal Data and Environmental Feedback*. In Int'l. Conf. in Computer Vision Systems (ICVS). Springer, 2015. [\[pdf\]](#)

PROJECTS

- **Multimodal Sentiment Evolution Analysis for Latent Risk Estimation.** This projects explores the estate of the art methods and techniques to extract community opinion and model its evolution as new sources of information (news, social influencers, policies, etc.). The evolution of the sentiment (extracted from sound, video, text/speech, and images) is correlated to community events and is used to estimate the latent risk to civilian and military personnel(e.g., first responders, fire fighters, police, medics, and military forces).

- **Complex Activity Analysis.** Use pair-wise relational RNNs to represent object-pair interaction evolution. This work explores the pair-wise spatio-temporal relations to better represent and detect complex activities. Some examples of these activities include: car collisions and near misses, human interactions in open spaces (in/out of cars), construction site body injuries, and warehouse-packing (correct and incorrect) processes.
- **UEG.** Uncertainty Estimation of the Graphical Neural Networks is a project funded by the National Geo-Spatial Agency (NGA). In my role as Principal Investigator (PI) I develop metrics and methods to estimate the uncertainty and robustness of Deep Neural Network (DNN) systems. The methods used random and targeted attacks at the layer level. The identified architectures for this project include AlexNet, VGG16, ResNet101, ResNet152, and Inception-v3, which are backbones of the most sophisticated object detectors (YOLO, TensorFlow-API, Mask-RCNN). The final portion of this project focused on devising object grouping methods that integrate object detection probabilities as part of their inputs. The developed solutions will strengthen the existing methodologies by making them more robust to attacks and increasing their generalizability.
- **H-MRCNN.** Hyperspectral Mask Region Convolutional Neural Network for methane detection in large overhead imagery (approximately $22,000 \times 1,500$ pixel) using hyperspectral (AVIRIS-NG) sensor measurements with 432 bands. This work combines match-filtering with deep neural networks to effectively represent, detect, and characterize amorphous gas plumes. The project is funded by the Aerospace Corporation.
- **FVOD.** Foveated Vision Object Detection is a project funded by NavAir. In this project as serve as Sr. Researcher and develop ship detectors that work on overhead observations (images from UAVs, Drones, and Satellites). In addition, I devise ship trackers and ship activity and event analyzers (e.g., in formation, approaching, docking, launching, towing, etc.)
- **AL.** Active Learning Based Scalable Representations for Event Understanding in Video is funded by the Office of Naval Research (ONR). In this project I serve as Sr. Researcher and develop activity and event representations and detectors using relational and par-wise analytics. In particular, I devise pair-wise groupings for activity and event representation. The activities and events of interest include car collisions, surveillance (e.g., people in outdoor scenarios such as parking lots and indoor scenarios such as warehouses).
- **FOM.** Figure of Merit is a project funded by NavAir. In this project I served as support Sr. Researcher and develop multimodal methods for cross modality data analytics, object detection, scene analysis, and validation.
- **DARE.** Document Analysis via Response and Entropy (DARE) is a system based on *n-gram* entropy statistics to represent and classify text content of technical drawings. The methods are modular and the algorithms are highly adaptive. These can be used to represent and classify various document elements including titles, reference (i.e., revision) numbers, and authorship among other applications without language limitations. The prototype system is optimized using multiprocessing techniques.
- **PCAS.** Process Estimation via Contextual Analysis and Sentiment (PCAS) is a framework to process, represent, classify, and profile submittal data in construction management applications. The objective is to identify elements that correlate with processes approval (approved or rejected) and timeliness (early, on-time, or late) outcomes.
- **Account Health.** A cohort segmentation and analysis system for data correlation and account event estimations (churn, downgrade, renew, and upgrade). The project involves time-series analysis to attribute trends (i.e., sequences) and gains using large decision trees to determine attribute entropy and hierarchical relevance.

- **Smokr.** A web-footprint cloud-based system to predict smoker-likelihoods. The system collects data from multiple sources, which includes membership, text content, frequency, etc. The content data is scraped, mapped, and quantized effective to represent the various elements. Text is tokenized and processed to compute sentiment vectors and extract meaningful keywords. The model is currently being used in production to fast-track life-insurance under-writings.
- **R3DT.** A distributed multimodal multiview system of smart sensor for Interaction Monitoring and Validation. The nodes are controlled by RaspberryPi3s running Ubuntu, customized sensor drivers for RGB-Depth, and Thermal device control and data collection. The devices communicate and are synchronized using in-house software solutions implemented in Python to work with OpenCV, Pandas, HDF5, OpenNI/PCL, TCP/IP, and Scikit-Learn. The analysis currently being expanded via convolutional neural nets
- **Eye-CU - Monitoring Healthcare Environments.** A distributed system of smart sensor nodes to monitor hospital environments. The ARM devices (RaspberryPi3s) run Ubuntu, customized sensor drivers, and in-house software for communication, synchronization, and data acquisition and analysis (feature selection and extraction). Implemented in Python using OpenCV (python wrappers), Pandas, HDF5, OpenNI/PCL, TCP/IP, and Scikit-Learn.
- **Blur Measurement.** Quantization of image blur for video frames. Implemented Marziliano's 2002 (Sobel) and Pech's 2000 (Laplacian) methods. The methods were modified to work together using an overlapping grid and generate a blur signature. Prototyped in Python and implemented in C++.
- **Potential Games for Consensus.** Probabilistic Approach to Consensus Using Game Theory's Multi-Player Potential Games. Implemented in MATLAB.
- **Pandroid.** High-Definition Panorama Generator for Android Devices using fast-features and overlapping video frames. Implemented in Java for Android SDK.
- **Viewfinder Alignment.** "Using video to generate FAST panoramas". A highly involved project that uses image-keypoint detection and matching, image registration, and Random Sample And Consensus (RANSAC) techniques. Project prototyped in Python and deployed in Android.
- **Saliency Detection.** Comparing Local Features to Human Saliency and Gaze Patterns. Uses the SR-Research Eye-Link to collect user data and evaluate human scans on random images as an exploratory user study. Implemented using SR-Experiment Builder and Python.
- **Gaussian Mixture Models (GMMs) – "Who is talking?"** Speaker identification project based on probabilistic methods and human speech processing. Implemented in MATLAB.
- **Object Recognition.** Implementation and application of the SIFT descriptor and object classification with large vocabulary trees for efficient object detection. Eigenvalues for Eigenfaces: Face recognition class project in which we implemented the eigenfaces algorithm and performed face recognition of classmates using eigenvector contribution ratio. Implemented in MATLAB.
- **Rapidly-Exploring Random Trees (RRTs).** Robotics Motion and Navigation using random seeding to detect a path and avoid collisions. Implemented in MATLAB and Python.
- **Hidden Markov Models (HMMs) – "Uncovering the Mystery"**. This project used fundamental speech processing methods (backward & forward and Viterbi algorithms) for linear and statistical prediction of speech. Implemented in MATLAB.
- **Autonomously Placing Objects on Flat Surfaces using Force and Torque Sensors.** Undergraduate research project for the Healthcare Robotics Laboratory's custom-built El-E robot. Used the sensors on El-E's arm and hand/gripper to place objects on flat surfaces by detecting a collision and measuring when the object was before being released. Implemented in Python.

- **Singing Blaze.** Class project using Xilinx Spartan 3 Boards and PicoBlaze. Development board's I/O ports were used to read commands from the user (e.g., select a song from a limited playlist). Base on the user selection the system would play a song using a dictionary of notes, frequencies, and pitches. Implemented in Verilog 2001.

Poster Sessions & Presentations

- *RAM: Roles from Appearance and Interaction Maps.*
Carlos Torres, Archith J. Bency, Jeffrey C. Fried, and B.S. Manjunath. IEEE/ACM International Conference on Distributed Smart Cameras (ICDSC) - Invited Paper to Person Identification and Re-Identification. Stanford Univ., California. September 2017.
- *Deep Eye-CU (DECU): Summarization of Patient Motion in the ICU.*
Carlos Torres, Jeffrey C. Fried, Kenneth Rose, and B.S. Manjunath. IEEE European Conference on Computer Vision (ECCV). Amsterdam, The Netherlands. October 2016.
- *Eye-CU: Sleep Pose Classification for Healthcare using Multimodal Multiview Data*
Carlos Torres, Victor Fragoso, Scott Hammond, and B.S. Manjunath. IEEE Winter Conference on Computer Vision Applications (WACV). Placid Lake, NY. March 2016.
- *Embedded 3-D Systems for Action Recognition*
Isaac Flores, Carlos Torres, and B. S. Manjunath. University of California Santa Barbara, Summer Undergraduate Research Colloquium, 2013.
- *Priming Effects on Visual Scene Search*
Jared Bruhn, Carlos Torres, and B. S. Manjunath. University of California Santa Barbara, INSET Undergraduate Symposium, 2011.
- *Use of CD Spectroscopy to Assess the Biocompatibility of Silica-Based Materials*
Daryl K. Eggers, Gary R. Abel, Jr., Phillip J. Calabretta, Mitchell C. Chancellor, Carlos Torres. Society for Biomaterials. Annual Meeting, 2010.
- *Effects of Surface Chemistry on the Structure of Apomyoglobin in a Confined Environment*
Phillip J. Calabretta, Carlos Torres, and Daryl K. Eggers. USA-Mexico Workshop in Biological Chemistry, 2009.
- *Autonomous Object Placement using Force and Torque Sensors.*
Carlos Torres, Cressel D. Anderson, A. Jain, and Charles C. Kemp. National Institutes of Health (NIH) Annual Biomedical Research Conf. for Minority Students (ABRCMS), 2008.
- *Adsorption of Cytochrome c and Apomyoglobin to Modified Silica Glasses.*
Carlos Torres and Daryl K. Eggers. American Chemical Society (ACS), 2008.
- *Protein Adsorption and Conformation in Hydrophobic Nanoporous Silica-based Sol-Gel Glasses*
A.R.W. Gilbert, Carlos Torres, Daryl K. Eggers, and B. Mena. CSU Biotechnology Symposium, 2008.

Computer Skills (GitHub)

PROGRAMMING: LANGUAGES, LIBRARIES, AND FRAMEWORKS

Language	Libraries, SDKs, & Tools (highlights)
C#	Gadgeteer, Kinect
C++/C	HDF5, OpenCV, OpenNI, and PCL
Databases	MySQL & PostgreSQL
Java	Android SDK
Matlab	Computer Vision, Image Processing, ANNs (& other) toolboxes
Processing	Arduino, OpenNI
Python	Beautiful Soup, CVXPY, HDF5, Keras, NLTK, OpenCV, OpenNI, Pandas, PCL, PyTorch, Scikit-Image/Learn, TensorFlow, & XGB
Verilog 2001	Xilinx Vivado 2013.4
Repositories/PM	Git (Bitbucket/Github), SVN, Jira & Confluence
Miscellaneous	AWS, Datadog, Docker, L ^A T _E X, MASM 1.2, NLP, Spark, Google ML Cloud, IoT, OMAP, ARM, Raspberry Pi, and SSH
Expertise	Computer Vision; Machine Learning; Deep Learning; Interaction Representation and Learning; Object Representation, Detection, Tracking, and Reidentification; and Distributed Sensor Networks
Operating Systems	MacOS, Linux, and Windows - and related software applications