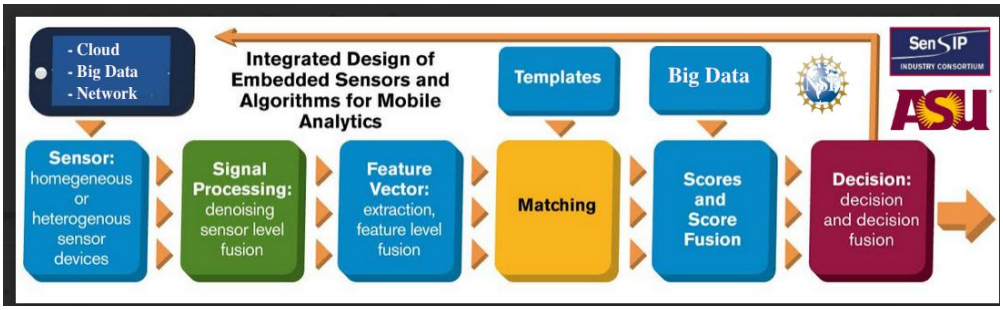
International Sensors, Signal Processing and Communications (ISSPC 2016) Workshop

Final Program

USA – Mexico, Industry-University Event, May 24-25, 2016
Tecnológico de Monterrey (ITESM) and Arizona State University (ASU)
At University Club, ASU, Tempe Arizona

Industry and University Presentations, Student and Faculty Poster Sessions



Sponsored in part by NSF International Programs, the NSF I/UCRC program and the ASU SenSIP Center.
Technical Co-Sponsor: IEEE Phoenix SPCOM Chapter

https://engineering.asu.edu/sensip/isspc2016/

PROGRAM – International Sensors, Signal Processing and Communications (ISSPC 2016)
Collaborative ASU SenSIP-ITESM Workshop at ASU, University Club, May 24-25, 2016

DAY 1: May 24

7:30am to 8:00am		Registration
8:00am to 8:10am		*Welcome – Andreas Spanias, ASU SenSIP NCSS I/UCRC Site Director*
8:10am to 8:20am		*Opening Remarks: Sensor Initiatives – Yong-Hang Zhang, Assoc. Dean & Professor, ASU*
8:20am to 8:30am		*Status of SenSIP Center – Andreas Spanias* *ASU-ITESM Relations, Paula Garcia-Hicks*
	Plenary Speaker	
8:30am to 9:00am	**MEMS Industry Group**	*The MEMS & Sensors Industry of today and the TSensors industry of tomorrow – Stephen Whalley*
9:00am to 10:20am	***Session 1: Data Analytics***	
9:00am to 9:15am	**GPEC**	*Sensor Innovation and Commercialization Center for Advanced Manufacturing – Maureen Howell*
9:15am to 9:25am	**IBM T.J. Watson**	*Task Driven Learning of Sparse Word Embeddings – Prasanna Sattigeri*
9:25am to 9:35am	**Lawrence Livermore National Lab**	*Design and Synthesis of Spectral Sampling Distributions for Data Analysis – Jayaraman J. Thiagarajan*
9:35am to 9:50am	**IBM T.J. Watson**	*Multimodal Data Analysis in Radiologist Workflows – Deepta Rajan*
9:50am to 10:05am	**ASU**	*From Cheap Sensing to Actionable Information via Dynamics: Applications in Healthcare and Surveillance – Pavan Turaga*
10:05am to 10:20am	**ASU**	*Empirically-estimable Performance Bounds for Machine Learning – Alan Wisler*
10:20am to 10:30am	*Coffee Break*	
10:30am to 11:30am	***Session 2: Localization and Communications***	
10:30am to 10:45am	**ASU**	*Consensus Networks and Communications – Cihan Tepedelenlioglu*
10:45am to 11:00am	**Clarkson University**	*CRLB Analysis in Sequential Localization – Mahesh K. Banavar*
11:00am to 11:15am	**Tech de Monterrey**	*Position Location in Reconfigurable Networks: Pyramidal Approach – Cesar Vargas-Rosales*
11:15am to 11:30am	**Tech de Monterrey**	*Position Location Using a Single Locating Site – Edwin Mera*
11:30am to 12:00pm	***Session 3: Industry Relations and IP***	
11:30am to 11:40am	**ASU**	*Collaborative Industry – University Proposals – Joelina Peck*
11:40am to 11:50am	**ASU**	*Industry Relations – John Mitchel, GOEE*
11:50am to 12:00am	**AZTE**	*Working with ASU on Intellectual Property Matters – Philip Dowd*
12:00pm to 1:00pm	*Lunch Break*	
1:00pm to 2:50pm	***Session 4: Sensors and Signal Processing***	
1:00pm to 1:15pm	**NXP Semiconductors**	*Tools & Lessons Learned for Sensor Data Analytics – Michael Stanley*
1:15pm to 1:30pm	**Formerly Intel**	*Biology Inspired Adaptive Models: An Introduction – Brian Mears*
1:30pm to 1:45pm	**Formerly Intel / ASU**	*Applications of Image Processing and Quality Metrics: from Consumer Video to Computer Vision – Jorge Caviedes*
1:45pm to 1:55pm	**ASU**	*Reconstructionless Compressed Sensing Video Tracking – Henry Braun*
1:55pm to 2:10pm	**Tech de Monterrey**	*A Wireless Reconfigurable Network model for Multiuser systems – J.M. Velázquez-Gutiérrez*
2:10pm to 2:20pm	**ASU**	*Consensus-based Distributed Estimation in Wireless Sensor Networks – Jongmin Lee*
2:20pm to 2:35pm	**Tech de Monterrey**	*Position Location in 3-D Ad-hoc Networks – Rafaela Villalpando-Hernández*
2:35pm to 2:50pm	**Prairie View A&M University**	*Robust Synchronization Controller Design for Distributed Three-Phase Inverters – Yongpeng Zhang*
2:50pm to 3:00pm	*Break (set up posters)*	
3:00pm to 5:00pm	***Poster Session / Open House – Coffee Refreshments***	

POSTERS

Poster 1 Optical Flow for Compressive Sensing Video Reconstruction, H. Braun
Poster 2 Direct Tracking from Compressive Imagers: A Proof of Concept, H. Braun
Poster 3 Direction of Arrival Detection Problem Using Virtual Array Concepts, Y. Rong
Poster 4 Empirical Bounds on Machine Learning Performance: Applications to Pathological Speech Processing, A. Wisler
Poster 5 Minimally Supervised Machine Learning for Condition Monitoring of Machinery, J. Lee
Poster 6 Integrating Machine Learning to Embedded Sensor Systems for Distributed Internet-of-Things Applications, J. Lee
Poster 7 Cross Platform Sensor System Monitoring for Solar Array Analytics, D. Ramirez
Poster 8 Irradiance Estimation for a Smart PV Array, H. Braun
Poster 9 Human Activity Recognition with Smartphone Sensors, H. Song
Poster 10 Maximum Likelihood Channel Estimation for Residual Self-Interference Cancellation in Full Duplex Relays, X. Li
Poster 11 Development of Hardware and Software for a Game-Like Wireless Spatial Sound Distribution System, C. Dharmadhikari
Poster 12 Dynamic Scheduling for Delay Guarantees for Heterogeneous Cognitive Radio Users, A. Ewaisha
Poster 13 Max-Consensus Using the Soft Maximum, S. Zhang
Poster 14 Development of Mobile Sensing Apps for DSP Applications, D. Rajan
Poster 15 iJDSP: iOS Signal Processing Laboratory for the iPod Touch, iPhone and iPad, S. Hu
Poster 16 Digital Signal Processing Algorithms for Silicon Io-Channel Sensors, A. Spanias
Poster 17 SenSIP Global Engagement Projects
Poster 18 Feature Fusion in Machine Learning Problems, H. Song
Poster 19 Musical Query-By-Humming Search: Analysis and Implementation of the State of the Art, D. Ramirez
Poster 20 A Robust Adaptive Beamforming Method with Quiescent Pattern Control, J. Fan
Poster 21 Aim of Fault Detection using Research Facility containing 104, 18kW, Solar Array Panels, S. Rao
Poster 22 Health Monitoring DSP apps, U. Shankar
Poster 23 Sequential Utility Maximization for Dynamic Spectrum Access, L. Ferrari
Poster 24 Mobile Modules for Multidisciplinary STEM Education, A. Spanias
Poster 25 Echolocation Based Ranging and Spatial Acoustic Analysis. M. Banavar (Clarkson University)
Poster 26 Using estimation theory to improve energy expenditure estimation of physical activities from wearable sensors, Q. Wang
Poster 27 Monitoring Physiological Signals Using Camera, F. Tsow (Earthlink)
Poster 28 ASU-ITESM Collaboration, A. Spanias
Poster 29 Graduate SenSIP Certificate, A. Spanias
Poster 30 The SenSIP Industry Consortium: A Site of the Net-Centric I/UCRC

Day 2: May 25

8:30am to 9:00am	Breakfast Summary of first day presentations and posters (ASU and ITESM leaders)
10:00am to 11:00am	Break Out Sessions (teams will be defined more precisely later) Themes will be defined as follows A. Joint Proposals B. Joint Paper Planning C. Student Exchange Program D. Industry Relations E. Planning of Workshop at Monterrey F. Scholarships Groups Report Back Action Items
11:00am to 12:00pm	Proposals to CONACYT and NSF
12:00am to 1:30pm	Lunch Lab Visits Training Session – Adaptive Filters Adjourn 4pm

Day 1, May 24, 2016:

Plenary Speaker

The MEMS & Sensors Industry of today and the TSensors industry of tomorrow *– Stephen Whalley (Chief Strategy Officer, MEMS & Sensors Industry Group)*

With the advent of smart phones and game controllers in 2007, and more recently with a plethora of other CE devices, wearables and now the Internet of Everything/Things (IoE/T), sensors are experiencing unprecedented growth. Forecasts for sensor demand are as high as 100 trillion by 2030. This presentation will outline some of these growth drivers and focus on what lies ahead for new forms of delivery vehicles for MEMS and sensors beyond today's fab based components. Flexible, hybrid and printed sensors will provide some alternatives in the next few years, but what will drive ultra-high volumes and lower costs in the next decade? The future IoE/T landscape will require deployment of printed electronics, antennas, power sources, transistors and sensors to enable multiple orders of magnitude cost reduction per square meter. Stretchable plastic and thin film substrates and ultimately roll-to-roll printing on paper will serve various application, cost, performance and form factor needs. A call to action to the industry will also be proposed to ensure challenges are addressed to realize the opportunities.

Biography*:* Steve Whalley is the Chief Strategy Officer, MEMS & Sensors Industry Group (MSIG), where he is leading efforts to scale the MEMS and sensors ecosystem for the next decade of explosive growth. He is a former MSIG board member and 26-year veteran of Intel Corporation with over 30 years in the semiconductor and MEMS/sensors industries. While at Intel he directed strategy for cross-platform efforts on sensors, multiple wired and wireless I/O technologies, power management and other initiatives. Moving to Chandler, Arizona in 1990 from the United Kingdom, Whalley has managed multiple product and technology development programs in various areas of Intel. He joined Intel in February 1988, working as a European Marketing Manager in Swindon, England. Whalley earned a Bachelor's of Science Degree in Electrical Engineering, graduating with Honors from the University of Salford, England. He also received a Master's Degree in International Management from the American Graduate School of International Management ("Thunderbird") in Arizona.

Session 1: Data Analytics

Sensor Innovation and Commercialization Center for Advanced Manufacturing *– Maureen Howell (Greater Phoenix Economic Council, GPEC)*

Abstract – The Greater Phoenix Economic Council (GPEC) in conjunction with the Partnership for Economic Innovation (PEI) and industry partners are working together to enhance the ecosystem for sensor technologies. This effort focuses on the integration of research and integration of technology and connecting innovation and whole solutions to end users via commercialization. The proposed model moves away from a traditional consortium and towards a "collaborative" that focuses cluster enhancement and revenue returns for collaborative members.

Task Driven Learning of Sparse Word Embeddings *– Prasanna Sattigeri (IBM T J Watson Research Center)*

Abstract – The recent surge in representation learning has resulted in remarkable advances in a variety of applications including computer vision and speech processing. In the context of natural language processing, much effort has been focused on constructing vector space representations for words through neural language models. In this work, we propose to infer the appropriate sparsity pattern for the word embeddings while learning the sentence composition in a deep network. In particular, we consider a unordered composition setting, similar to wherein the sentence representation is obtained as the average of the words. The proposed approach produces competitive results in sentiment and topic classification tasks with high degree of sparsity. It is computationally cheaper to compute sparse word representations than existing approaches. The imposed sparsity is directly controlled by the task considered and leads to more interpretability.

Design and Synthesis of Spectral Sampling Distributions for Data Analysis *– Jayaraman J. Thiagarajan (Lawrence Livermore National Laboratory)*

Abstract – In a variety of exploratory data analysis problems, the first step is to create an initial uniform, random sampling of the space to create a baseline of knowledge. In its most generic form, the goal of sampling is to produce the maximal amount of information with the minimal number of samples. Existing sampling techniques employ a variety of geometric heuristics to optimize the spatial arrangement of samples. However, recovering the underlying functions using these samples is fundamentally a reconstruction problem, and hence one can produce more effective sampling patterns by exploiting the connection between the Fourier domain characteristics and the spatial statistics. In this work, we present a general mathematical framework for design and analysis of spectral sampling distributions such as the Poisson disk and blue noise distributions. Using examples in surrogate modeling and image reconstruction we demonstrate the superiority of these samplings in comparison to conventional approaches.

Multimodal Data Analytics in Radiologist Workflows *– Deepta Rajan (IBM T J Watson Research Center)*

Abstract – This paper will provide a broad overview on the challenges faced in automated analysis of DICOM studies to isolate anomalies and in integrating multimodal information towards understanding disease evolution. Furthermore, the impact of well designed data platforms and learning algorithms on addressing pain points in a radiologist's workflow will be highlighted. The current trends in choice of tools and technologies pursued to build such big data systems in comparison to other computer-aided diagnostic tools will also be discussed.

From Cheap Sensing to Actionable Information via Dynamics: Applications in Healthcare and Surveillance *– Pavan Turaga (Arizona State University)*

Abstract – In this talk, we look at the broad problem of understanding dynamics in physical human activity from wearable devices and visual sensors. We provide an overview of a new class of geometry-inspired methods for modeling dynamics that we show to be significantly robust than classical approaches especially at low sampling-rates and small signal-lengths. We show applications of the proposed methods in activity recognition and in balance assessment for Parkinson's disease.

Empirically-estimable Performance Bounds for Machine Learning *– Alan Wisler (Arizona State University)*

Abstract – This paper describes a set of non-parametric performance bounds that can be estimated directly from data and applied to a range of different classification problems. The estimation of many performance bounds, such as the well-known Bhattacharyya bound, are based on the assumption that the data conforms to a particular parametric model (e.g. Gaussian) and as a results may be heavily biased when this assumption is violated. By avoiding parametric assumptions the bounds discussed in this paper are more robust to different types of data. In this paper we will summarize methods of directly estimating performance bounds for binary classification, multi-class classification, regression, and domain adaptation problems.

Session 2: Localization and Communications

Consensus Networks and Communications – *Cihan Tepedelenlioglu (Arizona State University)*

Abstract – An overview of two topics, distributed consensus, and relay networks is given. The distributed consensus problem has broad applications in areas such as sensor networks and computer networks. We consider a distributed network where nodes are reaching consensus on the average value of some initial measurements. Consensus on the maximum, and quantiles are also considered. In addition, we consider communications problems where relays are used to improve the range of communications. Full-duplex two-way relays and cognitive radios with one-way relays are considered.

CRLB Analysis in Sequential Localization – *Mahesh K. Banavar (Clarkson University)*

Abstract – Localization accuracy is crucial in wireless sensor networks (WSNs). Localization in WSNs involved nodes usually at unknown locations and anchors at known locations. In this paper, a localization problem in a WSN with M anchors and N nodes is considered. In order to perform localization with fixed power requirements and limited communication range within the WSN, a sequential localization scheme is used, where anchors are used to find nodes, and nodes whose locations have been estimated, can be used as anchors for subsequent localization steps. In this problem, we specifically consider time of arrival (TOA) as the modality for localization. The Cramer-Rao lower bound (CRLB) on error in localization estimation is derived for sequential localization. The CRLB is compared with the least square algorithm for localization under the same model and conditions. Results show that sequential localization results in performance degradation due to error propagation through the process. Simulation results confirm that the CRLB forms a lower bound on the performance of the least square algorithm.

Position Location in Reconfigurable Networks: Pyramidal Approach – *Cesar Vargas-Rosales (Tech de Monterrey)*

Abstract – A pyramidal multilateration technique is introduced to estimate the location of users of an ad-hoc/sensor network. The methodology uses single-hop or multi-hop paths joining references to nodes to be located by range estimation between neighboring nodes. The algorithm is evaluated considering noise in the range estimation and randomness in the reference node positions. Simulation results show adequate position location information achieved for multi-hop scenarios.

Position Location Using a Single Locating Site *– Edwin Mera (Tech de Monterrey)*

Abstract – A novel position location technique is presented. It applies the principle that collinear scatterers exhibit the same Doppler-Shifted Frequency (DSF). A minimum number of collinear scatterers are used to estimate the mobile's location. The novelty and advantage of the proposed technique makes it reliable and efficient from an optimality perspective, since the location of the mobile is estimated using a single base station in a non-cooperative wireless networking scenario.

Session 3: Industry Relations and IP

Collaborative Industry – University Proposals *– Joelina Peck (Arizona State University)*

Abstract – This talk will discuss logistics of industry university collaborative proposals. Examples of such proposals will be presented. We will also discuss briefly some examples of international collaborative proposals.

Framework for Industry-University Collaborations *– John Mitchel (Arizona State University)*

Abstract – With constantly accelerating technological innovation in today's markets, it can be impractical for individual companies to contain all the technological expertise and resources required to retain technological leadership. Collaborating with universities is one way to harvest technological know-how and develop new workforce skillsets for the future. This talk will describe models which can be used to help optimize the effectiveness of industry-university collaborations.

Working with ASU on Intellectual Property Matters *– Philip Dowd (AZTE)*

Abstract – We describe the process of filing for intellectual property both predisclosure and full disclosure. We cover restrictions and dead lives for publications issues. IP disclosures on collaborative projects are also discussed.

Session 4: Sensors and Signal Processing

Tools & Lessons Learned for Sensor Data Analytics *– Michael Stanley (NXP Semiconductors)*

Abstract – This preview of an upcoming Sensors Expo presentation will compare and contrast a number of solutions for machine learning and sensor data analytics.

Biology Inspired Adaptive Models: An Introduction *– Brian Mears (Formerly Intel)*

Abstract – The complexity of modern SoCs is a major design challenge, especially in the context of IoT applications. Biological systems are naturally complex and can provide examples of design that engineers can learn from. A set of SoC design tools is being developed that have been inspired in part by biology and evolutionary concepts. This short paper outlines the approach and some of the ideas copied from nature.

Applications of Image Processing and Quality Metrics: from Consumer Video to Computer Vision *– Jorge Caviedes (Formerly Intel / Arizona State University)*

Abstract – State of the art image processing and visual quality metrics are critical for the success of consumer image and video processing, in particular to keep up with the progress in imaging sensors and display technology, e.g. HDR, 4K, HFR, and 360 video. They also meet the needs of the new platforms and usage modes, e.g. mobile, wearables, HMD, and AR. This talk will address even more exciting opportunities for image processing and quality metrics in the field of computer vision (CV). The core CV algorithms have made dramatic breakthroughs through convolutional neural networks and other deep learning methods. However, at the system level, performance remains the holy grail of applied CV as systems incorporate a multiplicity of sensors and sensor modalities. Research on the role of image processing, signal metrics, and performance metrics has only begun and has the potential to solve fundamental CV system level issues.

Reconstructionless Compressed Sensing Video Tracking – *Henry Braun (Arizona State University)*

Abstract – Compressed sensing (CS) requires use of a reconstruction algorithm to convert measurements to a usable, human-readable form. These algorithms are computationally demanding in high data rate applications such as real-time video processing. We have developed a prototype target-tracking algorithm that performs inference directly on compressive measurements, without the need for reconstruction. The prototype algorithm has been successfully tested on the CDNET2012 dataset, at compression ratios competitive with, and sometimes exceeding, the requirements of conventional reconstruction algorithms.

A Wireless Reconfigurable Network Model for Multiuser Systems – *J.M. Velázquez-Gutiérrez (Tech de Monterrey)*

Abstract – The high density of wireless devices (WDs) represent a collection of challenges for wireless networks (WN) due to physical and technical limitations. The dynamic and intermittent nature of Wireless Reconfigurable Networks (WRN) is attractive for structureless WN such as sensor networks. We introduce a model derived from a DS-CDMA system that exploits the available resources and at the same time has robustness to interference problems. This model requires a comprehensive selection of sequences in order to provide attractive features for multiuser systems. We show a performance comparison with a traditional DS-CDMA system.

Consensus-based Distributed Estimation in Wireless Sensor Networks – *Jongmin Lee (Arizona State University)*

Abstract – In fully distributed wireless sensor networks, we introduce consensus-based estimation methods where local nodes perform decentralized processing while exchanging their estimates with neighbors. Nonlinearity using a bounded function is considered in the distributed networks. Such bounded transmission in sensor networks results in reducing power consumption. We also consider distributed quantile estimation which is based on stochastic approximation.

Position Location in 3-D Ad-hoc Networks – *Rafaela Villalpando-Hernández (Tech de Monterrey)*

Abstract – Position Location Information (PLI) is becoming an important requisite for deployment of multiple services and applications in wireless ad-hoc networks. Three dimensional (3D) scenarios have to be taken into consideration to extend the applicability of PLI based services. However, 3-D ad hoc networks present several challenges for PLI acquisition techniques, since conventional triangulation algorithms are no longer applicable due to the lack of direct land fixed references and the inclusion of a third axis. In this paper, a position location algorithm apt for 3-D environments is formulated based on a convenient deployment of four Access Points (APs) in a Manhattanized environment. Feasibility of the proposed algorithm is examined through analytic and simulation processes.

Robust Synchronization Controller Design for Distributed Three-Phase Inverters – *Yongpeng Zhang (Prairie View A&M University, Texas)*

Abstract – With more and more distributed and renewable energy sources connected to the power grid, it will introduce different dynamics to the system, and power electronic interfaces are needed to enable efficient and flexible interconnections among different players. In recent works, sinusoidal denominators have been successfully included in the controller to achieve the true synchronization. In this presentation, robust stability analysis is made to define the tolerance boundary for the uncertainty of R, R-L, and R-C load uncertainties. Finally, the proposed boundary is verified with simulation.

VENUE

University Club
425 E. University Dr.
Tempe, AZ 85281

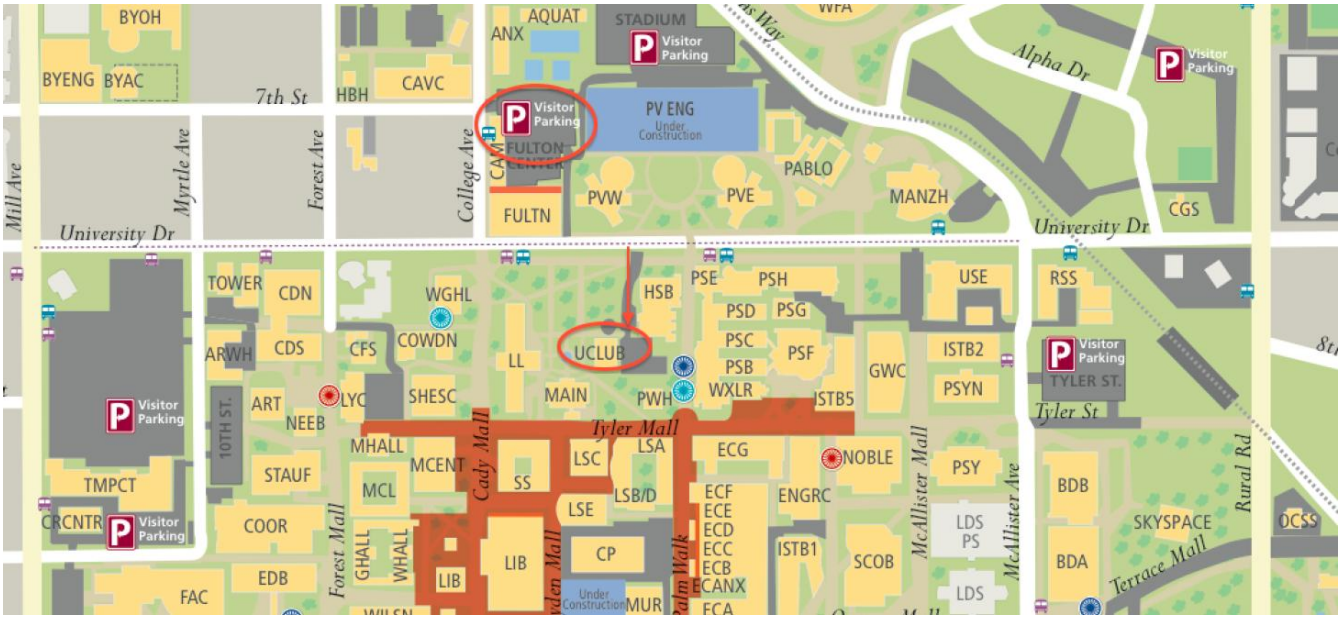
Directions from Loop 202 map

Exit off Scottsdale Rd/Rural Rd going south
Turn Right on University Dr.
Take the first left after Palm Walk
Go straight until you reach our parking lot

Directions form Interstate 60 map

Exit Rural Rd and go north
Turn Left on University Dr.
Take the first left after Palm Walk
Go straight until you reach our parking lot

MAP



Hotels

A. *Courtyard by Marriott Tempe* 601 S Ash Ave, Tempe, AZ, US, 85281 (3 star) Phone: (800) 321-2211
B. *The Graduate Hotel Tempe,* 225 E Apache Blvd, Tempe, AZ 85281 (3.5 star) Phone: (480) 967-9431
C. *Tempe Mission Palms* 60 E 5th St, Tempe, AZ 85281 (4 star) Phone: (480) 894-1400
D. *Moxy Hotel (formerly 1333 Hotel)* - 1333 S Rural Rd, Tempe, AZ 85281 (3 star) Phone: (480) 968-3451