ECE PhD Qualifying Exams

Presentation Schedule

Spring 2020

ECE QE Presentation Schedule

Spring 2020

Slide Number	Last Name	First Name	Date	Time	Venue	Title	PhD Advisor
4	Brueggeman	Avamarie Siming Fu	April 10, 2020	2:30 pm – 3:30 pm	ECSN 4.728	Cochlear Implant Analysis and Modeling for Audio and Music	John Hansen
5	Chandra Shekar	Meena Mudha	April 10, 2020	4:00 pm	ECSN 4.728	Knowledge based speaker tracking on a massive naturalistic audio corpora: Fearless Steps Apollo 11	John Hansen
6	Du	Lixiong	April 08, 2020	9:45 am – 10:45 am	ECSN 3.804	Develop New Power Converter Topology for 48V-to-1V Conversion	Brian Ma
7	Fan	Zhixuan	April 10, 2020	1:00 pm	ECSN 4.728	RFI and SNR Analysis for Large-Scale LEO Satellite-Based Radio Astronomy Systems and Large-Scale NGSO V-Band Satellite Communication Systems	Hlaing Minn
8	Gao	Tianning	April 09, 2020	2:00 pm	ECSN 4.702	Systematic VLSI Design Optimization Based on Machine Learning and High-level Synthesis	Dian Zhou
9	Ginn	Dustin Todd	April 16, 2020	11:00 am – 2:30 pm	ECSS 3.503	Comprehensive Survey on T-SDN: Software-Defined Networking for Transport Networks	Andrea Fumagalli
10	Hu	Yanke	April 10 , 2020	1:00 pm	ECSN 4.702	Healthcare Time Series Model Exploration in AI Era	Weili Wu
11	Huai	Pu	March 27, 2020	9:00 am – 10:00 am	ECSN 4.728	On the use of Floating Gate Transistors for Calibration and Locking of Analog Integrated Circuits	Georgios Makris/Andrew Marshall
12	Jain	Apurva	April 16, 2020	2:30 pm	ECSN 4.728	A new approach to timing analysis	Carl Sechen
13	Karbalayghareh	Mehdi	April 08, 2020	10:00 am	ECSN 4.728	Coherent Product Superposition for Downlink Multiuser MIMO	Aria Nosratinia
14	Khodabakhshi	Erfan	April 21, 2020	12:30 pm	ECSN 3.732	Design, Characterization and, Control of a High-bandwidth XYZ Nanopositioner	Reza Moheimani
15	Kwak	Jin Woong	April 08, 2020	10:45 am – 11:45 am	ECSN 3.804	Comparative Topology and Power Loss Analysis on 48V-to-1V Direct Step-Down Non-Isolated DC-DC Power Converters	Brian Ma
16	Lin	Wei-Cheng	April 13, 2020	3:00 pm – 4:00 pm	ECSN 4.702	An Efficient Temporal Modeling Approach for Speech Emotion Recognition	Carlos Busso
17	Mahmoud	Mohamed Hany Omar	April 06, 2020	11:00 am	ECSN 4.728	Upper Body Tracking for Driver distractions detection using computer vision	Naofal Al-Dhahir
18	Majumder	Sharmin	April 22, 2020	11:00 am – 12:30 pm	ECSN 4.728	Literature review of vision and inertial sensing fusion for continuous action recognition	Nasser Kehtarnavaz
19	Mohamed	Ahmed	April 10, 2020	12:00 pm – 1:00 pm	ECSN 4.728	Data Rate Analysis of a New Paradigm for Satellite Communications and Radio Astronomy Systems.	Hlaing Minn
20	Munia	Munawara Saiyara	April 02, 2020	3:00 pm – 4:00 pm	ECSN 4.728	EEG Analysis For Epileptic Seizure Monitoring Using Machine Learning	Mehrdad Nourani
21	Patel	Kashyap	April 16, 2020	10:00 am – 11:30 am	ECSN 4.702	Simultaneous Ranging and Self-Positioning in Unsynchronized Wireless Acoustic Sensor Networks	Issa Panahi
22	Pawaskar	Vaibhav Uttam	April 16, 2020	10:00 am	ECSN 4.728	Compact LCL filter with low coupling and damping loss for Medium Voltage high dv/dt PWM converters	Poras Balsara/Ghanshyamsinh Gohil

ECE QE Presentation Schedule

Spring 2020

Slide Number	Last Name	First Name	Date	Time	Venue	Title	PhD Advisor
23	Rodriguez Lopez	Ovidio	March 30, 2020	11:00 am	ECSS 3.503	Neural Bioelectronics; Advances, Limitations, Fabrication, and Opportunities	Lakshman Tamil
24	Sang	Mufan	April 14, 2020	3:00 pm – 4:00 pm	ECSN 4.728	Robust Text-Independent Speaker Verification with Neural Network Embeddings	John Hansen
25	Sears	Mark	April 09, 2020	2:00 pm	ECSN 4.728	FPGA Implementation Predictions with Machine Learning	Dinesh Bhatia
26	Sheikhlari	Sepehr	April 01, 2020	2:00 pm	NSERL 3.204	High-Frequency Thermally Actuated Electromechanical Resonators	Siavash Pourkamali
27	Smith	Josiah Wayland	April 20, 2020	12:30 pm	ECSN 4.728	Near-Field MIMO-ISAR Millimeter-Wave Imaging	Murat Torlak
28	Tang	Shengpeng	April 17, 2020	1:00 pm – 2:00 pm	ECSN 4.728	Design of High Conversion Ratio Power Converters	Hoi Lee
29	Tariq	Salahuddin	March 09, 2020	3:00 pm	TxAce Conference Room	A 400-GHz High-Gain Quartz-Based Single Layered Folded Reflectarray Antenna for Terahertz Applications	Kennenth O
30	Tiryaki	Erhan	April 13, 2020	1:00 pm	ECSN 3.508	COMPUTER AIDED DIAGNOSIS OF VENTRICULAR ARRHYTHMIAS FROM ECG LEAD II SIGNALS	Lakshman Tamil
31	Wang	Haokun	April 10, 2020	11:00 am – 12:00 pm	ECSN 4.702	NVH property of Switched reluctance motor based on Bearing Modeling and analysis	Babak Fahimi
32	Wang	Huaduo	March 27, 2020	2:00 pm – 3:00 pm	ECSN 4.728	Autonomous driving control, issues and techniques	Babak Fahimi
33	Zhang	Yujie	April 03, 2020	10:00 am	ECSW 3.375	Prediction of Wind Direction based on Machine Learning Methods	Mario Rotea

Cochlear Implant Analysis and Modeling for Audio and Music

Avamarie Siming Fu Brueggeman

April 10, 2020 2:30 PM – 3:30 PM ECSN 4.728

Abstract:

For people with severe hearing loss, cochlear implants are often able to restore a sense of hearing and significantly improve the ability to understand speech. However, enjoyment of music with cochlear implants remains a challenge due to factors including the technical limitations of implants and the high temporal and spectral complexity of music. Recent advancements for improving music accessibility with cochlear implants include utilizing dimensionality reduction techniques to reduce the spectral complexity of music. In this presentation, we will consider how music complexity may affect spectral complexity preference.

PhD Advisor: Dr. John Hansen

Knowledge Based Speaker Tracking on a Massive Naturalistic Audio Corpora: Fearless Steps Apollo 11

Meena Mudha Chandra Shekar

April 10, 2020 4:00 PM ECSN 4.728

Abstract:

Apollo-11 was the first manned space mission to successfully bring astronauts to the moon and return them safely. For such time and mission-critical naturalistic data, there is an extensive and diverse speaker variability impacting the performance of speaker recognition and diarization technologies. Hence, analyzing and assessing tradeoff in speaker recognition technologies for this dataset could help build robust speaker models for such corpora and address multiparty speaker situations. In this study, a small subset of 100 hours derived from a collective 19,000 hours of the Fearless Steps Apollo-11 audio data corresponding to three challenging phases of the mission: Lift-Off, Lunar-Landing and Lunar-Walking were used. A speaker recognition is performed on 140 speakers out of 183 NASA mission specialists who participated, based on sufficient training data obtained from five primary channels. The speaker identification systems are explored using three systems (i)i-vector (CDS and PLDA), (ii)x-vectors (CDS and PLDA) and (iii)convolutional neural network architecture called SincNet across all three Apollo-11 phases. For further analysis, speaker models trained on specific phases are compared with each other to determine how speaker duration, channel noise can impact the robustness of the models.

PhD Advisor: Dr. John Hansen

THE UNIVERSITY OF TEXAS AT DALLAS
Erik Jonsson School of Engineering and Computer Science

Develop New Power Converter Topology for 48V-to-1V Conversion

Lixiong Du

April 08, 2020 9:45 AM – 10:45 AM ECSN 3.804

Abstract:

The 48V power architecture is widely employed for power distribution in data centers. Conventionally it applies a 12V intermediate bus and a 12V-to-1V point-of-load (PoL) converter for power delivery. However, this two-stage approach degrades the overall efficiency and increases the cost. To improve the system performance, a single-stage 48V-to-1V DC-DC converter must be developed to meet the market needs. To mitigate the voltage stress issue, this presentation reviews state-of-the-art power converter topologies. Meanwhile, a new power converter is proposed and validated. With the similar silicon cost and system volume, a comparative study has been conducted.

PhD Advisor: Dr. Brian Ma

RFI and SNR Analysis for Large-Scale LEO Satellite-Based Radio Astronomy Systems and Large-Scale NGSO V-Band Satellite Communication Systems

Zhixuan Fan

April 10, 2020 1:00 PM ECSN 4.728

Abstract:

Large-scale non-geostationary orbit (NGSO) satellite communication systems (SCSs) is becoming a trend for global wireless communication. However, in view of the scarce spectrum resources, industry is seeking for higher frequency band like V-band for high capacity communication. In addition, due to the large-scale satellite systems' transmission, the radio frequency interference (RFI) can be caused onto radio astronomy systems (RAS) on the earth. Therefore, a LEO satellite-based RAS is proposed to lower the impact from SCSs and obtain both wide-range and clearer observations. We first analyze the impact of RFI both on this LEO satellite-based RAS's continuum observations and VLBI observations. Secondly, this paper also compares the SNR performance of ground telescopes and LEO satellite-based telescopes, which illustrates some advantages of LEO satellite-based telescopes in some certain cases.

PhD Advisor: Dr. Hlaing Minn

Systematic VLSI Design Optimization Based on Machine Learning and High-level Synthesis

Tianning Gao

April 09, 2020 2:00 PM ECSN 4.702

Abstract:

Designing modern digital VLSI circuits is an enormously complex technical endeavor. It is common to cost engineers a lot of work on optimizing the design to have the best metrics as required in each domain of design flow. Many researches presented various application of machine learning algorithms to optimization in different domains. However, the improvement using these methods is still limited since optimum in one domain does not guarantee that result of the following domain is still optimal among all possible results. In this presentation, a systematic method is proposed to connect domains from behavioral design to physical design and optimize simultaneously across multiple domains. Logic synthesis and physical design domains are viewed as one black-box problem and optimized simultaneously rather than optimizing as two separate problems. High-level synthesis (HLS), which is proved to have enormous influence on improving metrics of the design by experimental results, automatically processes the transformation from behavioral design to RTL design. In addition, experimental results and future application of this systematic method will be presented as well.

PhD Advisor: Dr. Dian Zhou

Comprehensive Survey on T-SDN: Software-Defined Networking for Transport Networks

Dustin Todd Ginn

April 16, 2020 11:00 AM – 2:30 PM ECSS 3.503

Abstract:

Paradoxically, with an ever-increasing traffic demand, today transport-network operators experience a progressive erosion of their margins. The alarms of change are set, and software define networking (SDN) is coming to the rescue with the promise of reducing capital expenditures and operational expenses. Driven by economic needs and network innovation facilities, today transport SDN (T-SDN) is a reality. It gained big momentum in the last years, however, in the networking industry, the transport network will be perhaps the last segment to embrace SDN, mainly due to the heterogeneous nature and complexity of the optical equipment composing it. This survey guides the reader through a fascinating technological adventure that provides an organic analysis of the T-SDN development and evolution considering contributions from: academic research, standardization bodies, industrial development, open source projects, and alliances among them. After creating a comprehensive picture of T-SDN, we provide an analysis of many open issues that are expected to need significant future work, and give our vision in this path toward a fully programmable and dynamic transport network.

PhD Advisor: Dr. Andrea Fumagalli

Healthcare Time Series Model Exploration in AI Era

Yanke Hu

April 10, 2020 1:00 PM ECSN 4.702

Abstract:

Electronic Health Record (EHR) has been widely adopted in the US in the past decade, which provides an increasing interest for predictive analysis with clinical time series data. Recently, deep learning approaches such as Recurrent Neural Network (RNN) and attention based networks have achieved the state-of-the-art accuracy on several clinical time series tasks, but one shortcoming of the RNN is the slow processing due to its sequential nature. In this paper, we propose a Filter based Feature Engineering method and a two-phase auto hyperparameter optimization method, which fit very well to clinical time series scenario. Combined with two widely used tree boosting methods: XGBoost and LightGBM, we demonstrated that our approach achieved the state-of- the-art results with more than 100X speed acceleration compared with RNN methods on two MIMIC-III benchmark tasks: In Hospital Mortality Prediction and 25-Phenotype Classification. Due to its superior accuracy and faster speed advantages, our approach has broad clinical application prospect, especially assisting doctors to make right diagnosis and treatment prognosis in shorter invaluable time.

PhD Advisor: Dr. Weili Wu

On the use of Floating Gate Transistors for Calibration and Locking of Analog Integrated Circuits

Pu Huai

March 27, 2020 9:00 AM – 10:00 AM ECSN 4.728

Abstract:

It is common for floating-gate transistors to be used to trim analog integrated circuits (ICs) after fabrication, to correct for mismatch and variability in manufacturing. We here introduce a methodology that leverages this capability to prevent unauthorized use of analog ICs. This all-analog solution utilizes obfuscation of the programming voltages in the calibration process. The analog floating-gate transistors used in our method are designed such that they can only be programmed in one voltage direction. This prevents iterative programming to find the ideal operating points, and thus protects against brute-force or intelligent attacks attempting to guess the unlocking sequence is ensured through the inability to re-program, and the obfuscated trim requirement, known only by trusted users. Feasibility and effectiveness of the proposed solution is demonstrated and evaluated on voltage regulator and operational amplifier applications. To our knowledge, this is the first solution which leverages this analog-only method.

PhD Advisor: Dr. Georgios Makris/Andrew Marshall

A New Approach to Timing Analysis

Apurva Jain

April 16, 2020 2:30 PM ECSN 4.728

Abstract:

For deep submicron circuits state dependent characteristics like wire and input capacitance become dominant and when using conventional STA tools, designers use overly restrictive rules to ensure the design doesn't fail. We have tried to model a more accurate approach for timing analysis. Our approach uses a set of vectors to carry forward a set of worst-case signals to trace the worst-case path. Set of vectors is selected based on the worst rise and fall possible on each gate and the maximum load capacitance the gate can see. Actual worst-case waveform is propagated through this path to ensure we take accurate values for input capacitance and multiple input transition is accounted for. This approach will take longer to implement as it runs for multiple vectors but give more accurate results.

PhD Advisor: Dr. Carl Sechen

Coherent Product Superposition for Downlink Multiuser MIMO

Mehdi Karbalayghareh

April 08, 2020 10:00 AM ECSN 4.728

Abstract:

Individual links in a wireless network may experience unequal fading coherence times due to differences in mobility or scattering environment. In the broadcast channel, the method of product superposition is employed to find the achievable degrees of freedom (DoF). In a two user broadcast channel where one user has full CSIR and the other has none, a recent result showed that TDMA is strictly suboptimal and a product superposition requiring non-coherent signaling achieves DoF gains under many antenna configurations. This work introduces product superposition in the domain of coherent signaling with pilots, demonstrates the advantages of product superposition in low-SNR as well as high-SNR, and established DoF gains in a wider set of receiver antenna configurations. Two classes of decoders, with and without interference cancellation, are studied. Achievable rates are established by analysis and illustrated by simulations.

PhD Advisor: Dr. Aria Nosratinia

Design, Characterization and, Control of a High-bandwidth XYZ Nanopositioner

Erfan Khodabakhshi

April 21, 2020 12:30 PM ECSN 3.732

Abstract:

Scanning probe microscopes (SPMs) emerged as one of the most instrumental inspections and manipulation tools in research at micro and nanoscale. Regardless of the type, all SPMs encompass nanopositioning platforms to relatively position the probe and the sample both in the horizontal and vertical directions with ultrahigh precision. the mechanical bandwidth of the nanopositioning platform plays a crucial role in maximizing the achievable imaging rate in SPMs. This parameter is also significantly influential on the imaging quality by affecting the bandwidth of the embedded controllers. To achieve a high-bandwidth nanopositioner, various design trade-offs should be considered. In this work, the target is to design, characterize and control of a 3-degrees of freedom (3-DoFs) high-bandwidth nanopositioner with the overarching goal of implementation within an STM for high-speed imaging and/or lithography. Bidirectional Piezoelectric stack actuation is selected due to its high force, high travel range and, large bandwidth. A flexural mechanism in the parallel kinematic configuration is designed to achieve a high bandwidth along both in-plane axes. In order to perform a high precision measurement of the in-plane displacement of the scan table, an interferometer sensor is employed with a nanometer resolution. For the out-of-plane displacement sensing, the piezoelectric sensing mechanism is considered. A stroke of 4 microns in in-plane and 2 microns in out-of-plane is achieved.

PhD Advisor: Dr. Reza Moheimani

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Comparative Topology and Power Loss Analysis on 48V-to-1V Direct Step-Down Non-Isolated DC-DC Power Converters

Jin Woong Kwak

April 08, 2020 10:45 AM – 11:45 AM ECSN 3.804

Abstract:

Along with the exponential growth in data centers, the power delivery system of the centers is widely adopting 48V power architecture in order to achieve less distribution (I2R) loss, higher power density, and reduced cost. However, 48V power architecture faces major challenge in its efficient conversion from 48V down to 1V for processor units. This presentation illustrates a comparative power loss analysis between half-bridge buck converter, multi-level buck converters, and hybrid buck converters. The performance of each converter was verified in high voltage 0.18µm BCD process. At effective switching frequency of 1MHz, hybrid buck converters achieve at least 19.2% higher efficiency than half-bridge buck converter for load range from 1A to 30A, and double series-capacitor buck converter achieves a peak efficiency of 91.95% at 7A.

PhD Advisor: Brian Ma

An Efficient Temporal Modeling Approach for Speech Emotion Recognition

Wei-Cheng Lin

April 13, 2020 3:00 PM – 4:00 PM ECSN 4.702

Abstract:

Speech emotion recognition (SER) plays an important role in multiple fields such as healthcare, education, and human-computer interaction. Emotional labels from most existing resources are annotated at the sentence-level (i.e., one label per sentence), resulting in a sequence-to-one recognition problem. Traditionally, studies have relied on standard acoustic feature sets, where low level descriptors (LLDs) are extracted at the frame level (e.g., fundamental frequency, energy, Mel frequency cepstral coefficients). These LLDs are used to obtain statistics at the sentence level (e.g., mean and standard deviation of the fundamental frequency). The size of the feature set is the same with this approach, regardless of the duration of the sentence. Recently, new deep learning architectures have been proposed to model temporal data. An important question is how to extract emotion-relevant features with temporal information. Existing solutions often assume that the sentences have a fixed duration, relying on zero padding for shorter sentences. This approach is not optimal. This presentation proposes a novel data processing approach for acoustic sequence, which combines gated/attention mechanism with multitask long short-term memory (LSTM) learning model. The approach creates windows with different overlap to process sentences with different durations. Our experimental results based on multiple datasets demonstrate that the proposed method not only significantly improves recognition accuracy, but also leads to computation efficiency.

PhD Advisor: Dr. Carlos Busso

Upper Body Tracking for Driver Distractions Detection using Computer Vision

Mohamed Hany Omar Mahmoud

April 06, 2020 11:00 AM ECSN 4.728

Abstract:

The association for safe international road travel reported that nearly 1.25 million people die, and additional 20-50 million people end up severely injured or disabled in road accidents every year. For youth between 15-29 years old, road accidents are the leading cause of death. The main cause of these accidents is the driver's distraction. Our research goal is to exploit data from different cameras and inertial sensors inside the vehicle to monitor and assess the visual attention of the driver, utilizing the camera frames and tracking the movement of the driver's upper body, including head, shoulders, and hands. The critical challenges in the real driving environments include the frequent changes in illuminations, variations in physical appearance, framework design for calibration-free conditions, and the proximity of the drivers where only the upper body is visible to the cameras. I will present a literature survey on upper-body tracking using convolutional neural networks (CNN) and semi-supervised learning, and how to associate body parts with individuals in the image for better accuracy tracking in a real-time performance.

PhD Advisor: Dr. Naofal Al-Dhahir

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Literature Review of Vision and Inertial Sensing Fusion for Continuous Action Recognition

Sharmin Majumder

April 22, 2020 11:00 AM – 12:30 PM ECSN 4.728

Abstract:

This presentation covers a literature review of action recognition techniques in which a wearable inertial sensor and a vision sensor are used simultaneously. After covering modern action recognition techniques using either vision or inertial sensing, the literature on the fusion of the two sensing modalities of inertial and vision are reviewed.

The hypothesis that will be examined is whether the fusion of these two sensing modalities achieves a more robust recognition outcome compared to the situations when each sensing modality is used individually. The focus of the presentation is placed on recognition of actions of interest in continuous action streams where actions of interest are performed randomly and continuously among actions of non-interest. Particular emphasis will be placed on deep learning techniques which have been found to be more effective than conventional machine learning techniques. Finally, possible extensions or improvements to the existing fusion approaches will be discussed.

PhD Advisor: Dr. Nasser Kehtarnavaz

Data Rate Analysis of a New Paradigm for Satellite Communications and Radio Astronomy Systems

Ahmed Mohamed Magdy Ahmed Mohamed

April 10, 2020 12:00 PM – 1:00 PM ECSN 4.728

Abstract:

Non-Geostationary orbit (NGSO) satellite communication systems (SCSs), namely low earth orbit (LEO) and medium earth orbit (MEO) systems, have been investigated for decades. Recently, due to the increasing demand for ubiquitous high-speed and low-latency Internet connections as well as the rapid development of low-cost commercial spacecraft launching, the space industry is planning to launch thousands of NGSO satellites. However, the NGSO SCSs' global downlink transmission can cause radio frequency interference (RFI) to the radio astronomy system (RAS) on earth. Instead of viewing large-scale NGSO SCS as an RFI threat, we view them as an opportunity to develop a new paradigm with mutual benefits for RAS and SCS. In our proposed paradigm, a large-scale NGSO satellites system is transformed from a communication service infrastructure into an integrated infrastructure for both communications and radio astronomy services. A pre-selected set of communication satellites will conduct RAS measurements in addition to providing their original communication services. The direct benefits are that RAS gains more radio astronomical observations (RAO) opportunities and performance enhancements and SCS obtains higher throughput and new services or business opportunities. The proposed approach is targeting the RAS data transport problem, trying to enhance the previously proposed algorithms.

PhD Advisor: Dr. Hlaing Minn

EEG Analysis For Epileptic Seizure Monitoring Using Machine Learning

Munawara Saiyara Munia

April 02, 2020 3:00 PM – 4:00 PM ECSN 4.728

Abstract:

Epilepsy, a neurological disorder caused by abnormal brain activity, affects around 50 million people worldwide. Epileptic seizure is caused by excessive and uncontrolled surge in neural electrical discharges which disrupts normal brain functionality. An electroencephalogram (EEG) is an ancillary test that contains information about the electrical activity of the brain and is used in the diagnosis of epilepsy. Scrutinizing the EEG to identify epileptiform abnormalities via visual inspection can be very time-consuming, as there are hours or days worth of EEG data that needs to be reviewed manually. Additionally, the nonlinear and nonstationary nature of EEG makes the signal highly complex, which makes it is very difficult to visually interpret the EEG signal and clinical interpretations may vary based on the reader expertise level to precisely identify abnormalities. Hence, the effort to develop a computer-aided diagnosis (CAD) system that can automatically detect epileptic seizures using machine learning techniques is an interesting ongoing research topic.

In this presentation, a methodology presented in literature will be discussed that proposed a 13-layer deep convolutional neural network (CNN) for automated categorization of normal, preictal (before seizure), and ictal (during seizure) epileptiform abnormalities. Each EEG signal was normalized with Z-score normalization and fed into the 1D deep convolutional neural network. The CNN is trained with a conventional backpropagation for 150 epochs. After each iteration of an epoch, 10-fold cross validation was performed to validate the performance of the CNN model. The proposed technique achieved an accuracy, sensitivity and specificity of 88.67%, 90.00% and 95.00% respectively.

PhD Advisor: Dr. Mehrdad Nourani

Simultaneous Ranging and Self-Positioning in Unsynchronized Wireless Acoustic Sensor Networks

Kashyap Patel

April 16, 2020 10:00 AM – 11:30 AM ECSN 4.702

Abstract:

Automatic ranging and self-positioning is a very desirable property in wireless acoustic sensor networks, where nodes have at least one microphone and one loudspeaker. However, due to environmental noise, interference, and multipath effects, audiobased ranging is a challenging task. In this presentation we will discuss a fast ranging and positioning strategy that makes use of the correlation properties of pseudonoise sequences for estimating simultaneously relative time-of-arrivals from multiple acoustic nodes. Synchronization issues can be removed by following a BeepBeep strategy, providing range estimates that are converted to absolute node positions by means of multidimensional scaling. We will also consider the performance in simulated and real experiments under different acoustical conditions.

PhD Advisor: Dr. Issa Panahi

Compact LCL Filter with Low Coupling and Damping Loss for Medium Voltage High dv/dt PWM Converters

Vaibhav Uttam Pawaskar

April 16, 2020 10:00 AM ECSN 4.728

Abstract:

Emerging medium voltage (MV) Silicon Carbide (SiC) 10 kV MOSFETs modules has helped in integrating simple structure such as, 2 level three-phase converter with grid through filters. Generally, for these converter systems LCL filter is widely been adopted. However, in LCL filter there exists a high-frequency current path considering the high dv/dt switching of these converters, leading to increased attention towards circuit parasitics. Thus, this leads to investigation of various approach for reducing the parasitic capacitance and introducing a simple dv/dt filter for MV converters to be connected in series with existing LCL filter by which the required attenuation can be achieved without adding any additional losses. Also, to gain high power density, multi-objective optimization is executed to achieve minimum volume and losses for the grid connected converter and for practical realization of filter. Obtained parameters are then considered for designing the filter inductor with different winding structures to reduce parasitic capacitance and verified by finite element analysis (FEA) results.

PhD Advisors: Dr. Poras Balsara/Ghanshyamsinh Gohil

Neural Bioelectronics: Advances, Limitations, Fabrication, and Opportunities

Ovidio Rodriguez Lopez

March 30, 2020 11:00 AM ECSS 3.503

Abstract:

Neural bioelectronics are an essential tool for the study of the nerve system and the treatment of neural diseases and disorders. Currently, neurotechnology has been used in the treatment of Parkinson's disease, suppression of epileptic seizures, and restoration of the hearing sense. Although progress has been made, the need to comprehend and improve the function of the human brain has been a consistent inspiration for neuroscientists and engineers to develop new technologies. For decades, neural devices have been evolving towards smaller, conformal and compliant implantable electronics capable of reading, modulating or stimulating the nervous system. This evolution has been permitted due to the advances in materials, electronic circuits, and microfabrication processes. Nowadays, neural implantable devices consist of a flexible polymeric substrate, electrodes, and connecting wires. This combination has allowed the development of spinal cord stimulation (SCS), nerve cuff, deep brain stimulation, cochlear implants, among others. However, the performance and chronic implantation remain limited by the size and density of electrodes, and the immunological response of the human body against a foreign object, among other issues. These limitations are mainly related to encapsulation methods, materials available, and microfabrication processes. During this presentation, I will give an overview of the advances in this technology, opportunities, and possible solutions to these drawbacks.

PhD Advisor: Dr. Lakshman Tamil

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Erik Jonsson School of Engineering and Computer Science

Robust Text-Independent Speaker Verification with Neural Network Embeddings

Mufan Sang

April 14, 2020 3:00 PM – 4:00 PM ECSN 4.728

Abstract:

Human speech as a performance biometric feature can be used to recognize the identity information of the speakers. Nowadays, speaker recognition technology gets more and more attention and applications in society such as e-commerce, law enforcement, and forensics. Text-independent speaker verification is to verify an unknown speaker who claims an identity using arbitrary words or sentences. Previously, I-vector based systems have been the state-of-the-art approach in the field. In recent studies, the neural network based approach has become a hotspot and dominant approach with leveraging large amounts of data. However, in reality, a mismatch always exists between training and evaluation dataset which leads to performance degradation. In order to address this problem, we purpose to use neural network model and domain adaptation to obtain robust and speaker discriminative embedding that compensates mismatch and improves the system performance in naturalistic environments.

PhD Advisor: Dr. John Hansen

FPGA Implementation Predictions with Machine Learning

Mark Ripley Sears

April 09, 2020 2:00 PM ECSN 4.728

Abstract:

In modern FPGA design flows, the large size of circuits and the unique nature of FPGAs demand efficient and specialized methods for mapping designs. This presentation explores the potential of machine learning techniques in FPGA physical design flows. One application is in block placement algorithms, which must consider wire congestion or else risk unroutability and poor timing results. Traditional heuristic estimation techniques for FPGA wire congestion on large modern designs yield inaccurate estimates or have unacceptably long runtimes. The use of a machine learning congestion estimator promises to increase estimation accuracy without significant computational overhead. This allows the congestion to be estimated many times during the placement process and opens up opportunity to greatly reduce congestion in troublesome areas before moving to the routing step.

PhD Advisor: Dr. Dinesh Bhatia

High-Frequency Thermally Actuated Electromechanical Resonators

Sepehr Sheikhlari

April 01, 2020 2:00 PM NSERL 3.204

Abstract:

Ultra High Frequency Micro/Nano electromechanical resonators underlie timing references, frequency sources, atomic force microscopes, gyroscopes, and mass sensors. In the past decade, there have been significant advances in the performance of micro scale electromechanical resonant devices including approaching to GHz range of frequency resonators and Q factor improvement of resonators. Among the micro scale electromechanical resonators, thermally actuated piezoresistive resonators have shown the high Q factor of 89000 along with the ability of approaching the ultra-high frequency of GHz rage by thinning down the narrow piezoresistive bar to nano scale.

In this presentation, the main principle of these types of resonators and the alternative approaches to reach the ultra-high frequency with high Q factor is studied.

PhD Advisor: Dr. Siavash Pourkamali

THE UNIVERSITY OF TEXAS AT DALLAS
Erik Jonsson School of Engineering and Computer Science

Near-Field MIMO-ISAR Millimeter-Wave Imaging

Josiah Wayland Smith

April 20, 2020 12:30 PM ECSN 4.728

Abstract:

Two-dimensional and three-dimensional radio frequency image reconstruction algorithms have been developed for near-field imaging applications such as concealed item detection, ground penetrating radar, through-wall imaging and nondestructive evaluation and classification. These methods employ millimeter-wave (mmWave) active transceivers operating in the GHz and THz frequency ranges. While conventional synthetic aperture radar (SAR) imaging algorithms are based on a monostatic, full-duplex framework, this work spotlights the progress towards efficient, robust near-field algorithms leveraging the concept of virtual arrays realized by multistatic multiple-inputmultiple-output (MIMO) radar systems. Using a wideband frequency modulated continuous wave (FMCW) multistatic MIMO radar system, three-dimensional holographic imaging algorithms are proposed, simulated, and implemented for the rectilinear SAR and cylindrical ISAR cases. The proposed algorithms overcome challenges inherent to the multistatic MIMO apertures such as virtual aperture, multi-channel array signal processing, multistatic MIMO calibration, and spatial sampling. In addition to MIMO-SAR, the MIMO inverse SAR (MIMO-ISAR) problem is discussed and addressed. This study investigates existing algorithms for efficient two-dimensional and three-dimensional holographic imaging on MIMO-SAR and MIMO-ISAR systems, proposes new efficient, near-field multistatic imaging algorithms, and demonstrates the implementation of novel super-resolution techniques on a MIMO-SAR and MIMO-ISAR mmWave FMCW system.

PhD Advisor: Dr. Murat Torlak

Design of High Conversion Ratio Power Converters

Shengpeng Tang

April 17, 2020 1:00 PM – 2:00 PM ECSN 4.728

Abstract:

Bringing more abundant power delivery in modern power supply system, front-end and bus voltage ratings tend to get higher in recent years. In this trend, the conventional step-down power conversion techniques could suffer from worse trade-off between the power density and the power efficiency. Moreover, with the continuous voltage shrinking in advanced data processors, the requirement of having larger current from the power converter further deteriorates this situation. In addition, some issues like short power-switch on-time and higher ringing voltage stress also place tough obstacles for circuit designers. In this talk, we will discuss the limitations of conventional step-down power converters and a design of transformer-based high-step-down converter to mitigate those issues above.

PhD Advisor: Dr. Hoi Lee

A 400-GHz High-Gain Quartz-Based Single Layered Folded Reflectarray Antenna for Terahertz Applications

Salahuddin Tariq

March 09, 2020 3:00 PM TxAce Conference Room

Abstract:

Compact high-gain antennas are highly desired in the high-speed terahertz (THz) wireless system, especially for the space limited application, such as the high-speed inter link inside the high density wireless communication base station. To this end, a 400-GHz folded reflectarray (FRA) antenna with high gain, high aperture efficiency, and compact profile is proposed in this paper. It is composed of a feed source, a single-layered reflectarray using a lithography process on quartz, and a wire-grid polarizer implemented by the printed-circuit-board technology. A 3-D printed fixture is used to assemble all parts together. In order to design accurately the proposed antenna, the THz electromagnetic properties of the supporting dielectric materials are extracted by using a THz time-domain spectrometer system. Then, a single-layered phasing element, made up of a pair of orthogonally I-shaped structures with an open square ring, is proposed and designed based on the extracted material characteristics. Both phase compensation and polarization conversion can be realized by the proposed unit cell. A reflectarray is designed by using the proposed phasing element with the conventional array synthesizing theory, and a THz grid polarizer is designed with strips on a 0.127 mm Taconic TLY-5 substrate. The THz grid is placed in front of the THz feed and the reflectarray, which is fully reflective to the feed and transparent to the reflectarray. All components of the FRA antenna have been fabricated and assembled. Experiments show that the FRA prototype has a peak gain of 33.66 dBi at 400 GHz with an aperture efficiency of 33.65%, and a 3-dB gain bandwidth of 16% (357–421 GHz).

PhD Advisor: Dr. Kenneth O

COMPUTER AIDED DIAGNOSIS OF VENTRICULAR ARRHYTHMIAS FROM ECG LEAD II SIGNALS

Erhan Tiryaki

April 13, 2020 1:00 PM ECSN 3.508

Abstract:

This presentation provides a computer aided diagnosis(CADx) of different type of ventricular arrhythmias, which are Ventricular Tachycardia (VT),Ventricular Fibrillation (VF), Ventricular Couplet (VC), and Ventricular Bigeminy (VB), from Electrocardiogram(ECG) signals. Six different data domains including time domain, Fourier domain, and four Wavelet domains (Daubechies, Coiflet, Symlet, and Meyer) are used in Support Vector Machine(SVM), Artificial Neural Network(ANN), K-Nearest Neighbors(KNN), and Naïve Bayes classifiers for detection.

PhD Advisor: Dr. Lakshman Tamil

NVH Property of Switched Reluctance Motor based on Bearing Modeling and Analysis

Haokun Wang

April 10, 2020 11:00 AM – 12:00 PM ECSN 4.702

Abstract:

The switched reluctance motors (SRMs) has increasingly draws the attention of both industry and academia due to its potential option for electric vehicle (EV) systems. SRM is known for their robustness and high efficiency as well as rare earth free. While the Noise,
Vibration and Harshness (NVH) issue could be annoying for the passengers. Therefore, predicting its acoustic properties at an early design stage can be substantially beneficial. According to relevant amount of studies, that most of the noise generated from the SRM comes from structural vibration due to electromagnetic air-gap forces acting on the stator, which create large deformations of the stator housing, causing serious vibrations and acoustic noise. However, the impact of the bearing to the housing deformation is a key part of the acoustic noise and should be drawn attention. In this study, a multiphysics FEA of an SRM is developed, with the main focus on the NVH and the sound power level is simulated using a boundary element method (BEM).An Empirical Mode Decomposition (EMD) based algorithm is applied to the noise analysis and prediction.

PhD Advisor: Dr. Babak Fahimi

THE UNIVERSITY OF TEXAS AT DALLAS
Erik Jonsson School of Engineering and Computer Science

Autonomous Driving Control, Issues and Techniques

Huaduo Wang

March 27, 2020 2:00 PM – 3:00 PM ECSN 4.728

Abstract:

Autonomous vehicles (AV) are widely expected to replace human drivers in the future transportation systems due to the potential of better safety, better road efficiency, and improved energy conservation. In general, an AV architecture includes three layers: the perception layer, which recognizes objects and constructs the perception model for the driving environment; the planning layer, which plans for routes and trajectories based on the perception model and predictions of the object movements; the vehicle controlling layer, which derive the kinematic control of the vehicle to follow the planned trajectories. I plan to explore the trajectory planning and vehicle control for autonomous driving during my PhD study.

In trajectory planning, the major algorithms like Voronoi and RRT (rapidly exploring random tree) has mainly been used in robotic control in arbitrary environment and may incur unnecessary overhead for the vehicular domain since the driving environment is generally not arbitrary. Applying Voronoi algorithm in driving can help tolerate minor deviations, but Voronoi does not provide a complete trajectory planning solution. In my presentation, I will discuss existing RRT and Voronoi algorithms applied for vehicle trajectory planning.

For autonomous driving control, PID (proportional-integral-derivative) controller is the de facto solution. However, deriving the best control parameters for a PID controller may still be an issue since in different driving environments, the best parameters can be quite different. I will survey and present the basic PID controller used in vehicle control as well as various parameter tuning methods for the PID controller. Also, MPC (Model Predictive Controller) has been considered for driving control since it yields better vehicle control results than PID, but the computation overhead of MPC may be more excessive. I will also present the basic MPC approach and consider the potential methods to integrate MPC with PID to improve driving control without high computation overhead.

PhD Advisor: Dr. Farokh Bastani

Prediction of Wind Direction based on Machine Learning Methods

Yujie Zhang

April 03, 2020 10:00 AM ECSW 3.375

Abstract:

Prediction of wind direction can help in maximizing the power production of wind farms, and optimizing the control strategy for individual wind turbines. The main challenge in wind direction prediction is to estimate couple-turbine groups without error. Due to unavoidable turbulence within wind farms, predicting the wind direction for all paired turbine groups becomes extremely difficult and nearly impossible in some cases. Therefore, we will investigate three methods that have been used to address this problem. In this work, we use the rotor speed and generated power of each turbine to accurately predict the wind direction observed by the turbine. The three methods considered in this study are Ridge Regression, Lasso Regression, and Neural Network techniques. They are used to identify turbines that are coupled. Using data obtained from the EAGER project, we present an analysis and discussion of each of the three proposed methods. The final result was that the Lasso regression method outperforms the other two methods, with respect to wind direction identification.

PhD Advisor: Dr. Mario Rotea

Thank You!