Boston Section

Supporting students, working engineers and retirees through professional development, education and resources.

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IEEE Boston Section

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IEEE Advancing Technology for Humanity

TABLE OF CONTENTS

Wigna Balasingham

Navigating the Maze of Ethics: Technology Giants, Data Privacy, and Artificial Intelligence

By Wigna Balasingham, Secretary/Treasurer, IEEE Boston Section

In the modern world, technology plays a critical role in our daily lives by innovating and transforming how industries operate. Technology giants such as Google, Microsoft, Facebook, Amazon, Tesla, and Apple are at the center of this revolution. These entities, alongside rapidly -evolving artificial intelligence (AI) technologies, hold vast amounts of personal data that influence our lives and economic growth. However, with great power comes great responsibility. The ethical implications of data privacy and AI are prime concerns for individuals, governments, and regulators worldwide.

Tech giants collect metadata containing personalized information, including geolocation, search history, and other curated data from website interactions. This includes targeted content and advertisement placement based on user searches and viewing habits. While a surface-level analysis might suggest this enhances user experiences, it raises numerous privacy and consent issues. Are users aware of how much and what data is being collected on them? Are they informed enough to make choices, or do they even have options?

Transparency is often an overused term in today's data privacy debate. Industry professionals require a thorough explanation of how data is collected, stored, and utilized. However, tech companies frequently obscure this information in tedious privacy policies full of jargon. The challenge lies in ensuring transparency while providing users with sufficient information to make informed choices regarding their data.

Accountability is equally vital. For example, data breaches and unauthorized access to personal information pose serious threats to individuals and organizations alike. Recent significant security breaches necessitated upgrades to security systems and highlighted the need for clear accountability. While government and regulatory bodies enhance their efforts to limit the power and control of major tech companies, rapid technological advancements often cause legislation to lag.

Unconscious bias represents one of the largest ethical challenges that AI continues to confront today. AI is trained on existing datasets that may contain societal biases. These datasets can reflect the prejudices prevalent in society, and AI can unintentionally reinforce and further entrench these injustices. These issues can be addressed through extensive testing, diverse training data, and ongoing efforts to identify and mitigate biases.

The latest wave of legislation, including the California Consumer Privacy Act (CCPA) and the European Union General Data Protection Regulation (GDPR), aims to establish higher standards for protecting user data. U.S. Vice President JD Vance announced the Trump administration's pro-innovation, anti-regulation policy for artificial intelligence at the AI Summit 2025 in Paris. He argued that excessive regulation could stifle the revolutionary potential of AI. Vance emphasized the need to foster innovation while ensuring that AI systems are free from ideological bias or authoritarian censorship. There should be a unified international framework for data privacy laws to provide consistent protection for consumers around the globe.

Investigations into DeepSeek and TikTok will likely result in tighter restrictions on how foreign tech companies can operate in the United States, both as a matter of national security and responsibility in data handling. Such measures could include, among other things, stricter data privacy regulations, export restrictions, and increased monitoring of AI technologies.

The announcement of the $500 billion Stargate Project, led by President Donald Trump in collaboration with other tech giants like OpenAI, Oracle, and

continued

SoftBank, aims to lay down roadmaps for establishing a robust AI infrastructure in the US. Launching this project will secure US dominance in AI, protect jobs, stimulate the economy, and bolster national security. Possibly the most significant technological outcome of the Stargate Project will be the construction of large data centers to meet the computational demands for AI models, creating hundreds of thousands of jobs.

AI innovation has the potential to revolutionize healthcare by detecting cancer in early stages and developing accurate, personalized vaccines. This would present a strategic opportunity for enhancing the economics of America and the entire world. Indeed, advancements in the medical field signal a move towards technological progress in AI research, keeping America at the forefront of AI technologies.

While one of AI's goals is to ensure privacy and protection, many AI-driven surveillance systems under development pose serious privacy risks. AI can collect and analyze vast amounts of personal information, from home devices to citywide surveillance systems. Although these technologies are marketed as safety measures, they can easily infringe upon individual privacy.

With an AI system, if an error occurs, where would the fault lie? Autonomous vehicles are known to reduce accident rates and may save lives in the future, but they raise significant questions about liability in the event of a crash. Establishing an ethical guideline that defines liability and ensuring that humans maintain control over AI decisions are critical first steps in overcoming these serious ethical challenges. Artificial Intelligence technology can significantly impact fundamental human rights, such as freedom of expression and thought. AI-driven predictive policing may disproportionately target certain populations, and algorithms for content moderation on social networks can inadvertently suppress free speech.

In conclusion, the relationship between big tech companies, data security, and AI is intricate and multifaceted. While these companies have the potential to innovate and change our lives for the better, they also bear the responsibility of protecting our personal data and adhering to ethical standards. Individuals are increasingly aware of their digital footprints, relying on companies to handle their data responsibly, and seeking greater control over it. Striking the right balance between data-driven innovation and privacy is arguably one of the most significant challenges we currently face. The actions we take now will shape the digital landscape for the next generation.

IEEE Advancing Technology for Humanity

2025 IEEE International Conference on Artificial Intelligence & Data Analytics

June 24, 2025

Tufts Engineering Graduate Programs, Medford, MA

2025 ICAD SPONSORSHIP OPPORTUNITIES

This new conference and exhibition will emphasize the applications of AI and key AI verticals that impact technology applications and innovations. The conference aims to provide an experience that prepares you to learn about new research and breakthroughs in AI, gain valuable insights, grow your network, and get inspired by the brightest minds working in this multi-faceted field.

We are inviting sponsorship from industries, businesses, and government agencies and various levels of sponsorship are possible. Based on the sponsorship level, the sponsor will have access to opportunities for advertising and/or displaying their products, making presentations and a number of free registrations to the conference. We can also customize opportunities like branded merchandise or student awards.

Benefit	Gold Sponsor	Silver Sponsor	Bronze Sponsor	Exhibitor
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Ad in Conference Program	1/2 Page	1/4 Page	Logo Only	
Complimentary Conference Registration	Four (4)	Two (2)	One (1)	
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IEEE Boston Section

IEEE Advancing Technology for Humanity

Sponsorship Guidelines

For all sponsorship levels, the sponsors' logos will be prominently displayed at all conference events, on the conference web site, as well as in any conference materials. Sponsorships at the Bronze level and above include one or more complimentary registrations for sponsor representatives, depending on the level of sponsorship. If you'd like to sponsor or have questions, contact Trina Lorigan: t.lorigan@ieee.org.

IEEE Boston Entrepreneur's Network ENET – 7:00 PM, Tuesday, March 4

Disciplined Entrepreneurship: 24 Steps to a Successful Startup

This is the Phoptonics Society monthly in-person seminar series. Light meals will be served (free of charge, registration required).

Meeting Location: LaSell University Science and Technology Center, Newton, MA

Time: 7:00 pm - 8:30 pm

Register Here

For food purposes, pre-registration is preferred, however, walk-ins are welcome to register at the door. Cash only.

Join MIT's Bill Aulet for "Disciplined Entrepreneurship: 24 Steps to a Successful Startup" with the Boston ENET community!

Bill will provide a systematic overview of exactly how to create a successful startup using a detailed, sequential, but non-linear, integrated, and proven 24-step framework that any entrepreneur can apply immediately to improve his/her chances of entrepreneurial success. He will also explain: the reasons that new ventures fail; that entrepreneurship is not an art, but rather a craft that can be learned; and why the best idea or product is no assurance of winning at all.

These explanations are also included in Bill's book, "Disciplined Entrepreneurship – Expanded & Updated" (2nd edition, c. 2024), which is perfect for aspiring startup founders and entrepreneurs within any organization. The 24 steps also provide an invaluable resource for anyone who has already begun the entrepreneurial journey and needs practical, hands-on tools to take his/her venture to the next level. Bill's talk will also help you refine your strategy and provide insights for startup success.

Whether you are a first-time founder or looking to pivot your startup, don't miss this opportunity to learn from Bill about his structured approach to create a clear pathway of disciplined entrepreneurship for a successful startup in 24 steps!

IEEE Boston Computer Society and GBC/ACM – 7:00 PM, Thursday March 6

How Privacy Enhancing Technologies (PETs) Lets Governments and Business Share Sensitive Data while Protecting Privacy

Location - MIT Room 32-G449 (Kiva) and via Zoom

Speaker: Simson Garfinkel

Event Registration Link: https://acm-org.zoom.us/webinar/register/9717379974555/WN_jwgTYmklQ-Su6Thc23XOMtQ. Please register in advance for this seminar even if you plan to attend in person. After registering, you will receive a confirmation email containing information about joining the webinar.

Indicate on the registration form if you plan to attend in person. This will help us determine whether the room is close to reaching capacity. We plan to serve light refreshments (probably pizza) before the talk starting at around 6:30 pm. Letting us know you will come in person will help us determine how much pizza to order.

We may make some auxiliary material such as slides and access to the recording available after the seminar to people who have registered.

Tax returns and financial filings, health records, education records, and crime data are just some of detailed and highly sensitive data that governments have about people.

Businesses also have huge archives of sensitive data, including consumer purchases, cellphone mobility traces, and video surveillance. Today a tiny fraction of these data are released as “open data” or sold as “de-identified data.” The rest are locked up, unable to benefit society or promote new economic activity. Worse, much of that allegedly de-identified data can actually be re-identified, as happened when journalists at The Pillar used de-identified data to identify Catholic priests who were going to gay bars and using hookup apps.

Privacy Enhancing Technologies (PETs) use advanced mathematics and computational techniques to let organizations analyze and publish sensitive data while protecting the privacy of individuals and sensitive data from organizations. These techniques have existed for
decades and are increasingly being deployed by governments and businesses. PETs are not without controversy. When the US Census Bureau adopted a PET called “differential privacy” for the 2020 Census, more than 4000 academics signed an open letter voicing their opposition: they were concerned that differential privacy would do such a good job protecting privacy that the resulting data would be useless for academic research.

This talk presents the case for PETs, explains popular PETs for a non-technical audience, and discusses the specific controversy of deploying differential privacy for the 2020 US Census.

This is discussed in more detail in his latest book Differential Privacy.

Simson Garfinkel (pictured above) is the Chief Scientist and Chief Operating Officer of *(continued)*

BasisTech in Somerville, Massachusetts. He was previously a program scientist at AI2050, part of Schmidt Futures. He has held several roles across government, including a Senior Data Scientist at the Department of Homeland Security, the US Census Bureau's Senior Computer Scientist for Confidentiality and Data Access and a computer scientist at the National Institute of Standards and Technology. From 2006 to 2015, he was an associate professor at the Naval Postgraduate School in Monterey, California. In addition to his research, Garfinkel is a journalist, an entrepreneur and an inventor; his work is generally concerned with computer security, privacy and information technology.

Simson is the author or co-author of 16 books, and the author of more than a thousand articles. He is a contributing writer for Technology Review and has written as a freelancer for many publications including Wired magazine, The Boston Globe, Privacy Journal, and CSO Magazine. His work for CSO Magazine earned him five regional and national journalism awards, including the Jesse H. Neal Business Journalism Awards in 2003 and 2004. He is also the editor of The Forensics Wiki.

Directions to 32-G449 - MIT Stata Center, 32 Vassar Street, Cambridge, MA: Please use the main entrance to the Stata Center at 32 Vassar Street (the entrance closest to Main street) as those doors will be unlocked. Upon entering, proceed to the elevators which will be on the
right after passing a large set of stairs and a MITAC kiosk. Take the elevator to 4th floor and turn right, following the hall to an open area; 32-G449 will be on the left. Location of Stata on campus map

This joint meeting of the Boston Chapter of the IEEE Computer Society and GBC/ACM will be hybrid (in person and online).

Up-to-date information about this and other talks is available online at https://ewh.ieee.org/r1/boston/computer/.

You can sign up to receive updated status information about this talk and informational emails about future talks at https://mailman.mit.edu/mailman/listinfo/ieee-cs, our self-administered mailing list.

Northeastern University

pels
IEEE POWER ELECTRONICS SOCIETY
Boston Chapter

INDUSTRY NIGHT

POWER ELECTRONICS & ENERGY SHOWCASE

An exciting evening of innovation and networking with Power Electronics Industry Leaders!

March 11, 2025
6PM - 7:30PM

McLeod Suites
Curry Student Center, 360 Huntington Ave, Boston, MA 02115

Pizza provided if you register!

What to Expect

- Meet leading power electronics and energy companies.
- Network with industry professionals and peers.
- Engineers will mentor students by providing exposure to cutting-edge technology development.
- Students bring your resumes! Many companies are hiring full-time or coop positions.

Register!

For exhibitors or attendees use QR code or link

https://forms.gle/HSnWttDeeZq3bkkx7

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IEEE Power Electronics Society

Join our Email list!

IEEE Boston Photonics Society – 6:00 PM, Thursday March 13

A 256-Channel SPAD Detector for Time-Gated fNIRS and DCS

Location - 3 Forbes Road, Lexington, MA

Speaker: Jonathan M. Richardson - MIT Lincoln Laboratory, USA

Event Registration Link: https://events.vtools.ieee.org/m/471090

Functional near-infrared spectroscopy (fNIRS) and diffuse correlation spectroscopy (DCS) have shown promise as non-invasive optical methods for cerebral functional imaging. Both approaches currently have limits to sensitivity in adults. Sensitivity can be improved using temporal discrimination, where the laser excitation is of short (~400ps) duration and the detector rejects early photons that have not penetrated into the brain while maintain high sensitivity to those that have. We report here the development of a novel Read-Out Integrated Circuit (ROIC) that integrates with a 32x32 Single-Photon Avalanche photo-Detector (SPAD) array that can be either silicon (Si, for visible to infra-red) in indium-phosphide (InP, to allow operation at 1064μm). The ROIC is designed to arm the SPADs in less than 500ps synchronous with the excitation pulse, keeping the total detection window as short as 3ns of arming to minimize sensitivity to dark events (thermal and discharge-related). The entire array can be operated at aframe rate of at least ~10MHz, giving a full “firemap” of which pixels have had events for each frame. Data is exfiltrated serially directly to an FPGA where it can be processed in real time. This presentation will include results of recent detector performance tests and phantom demonstrations using this powerful new tool.

Acknowledgments: This work was supported by the National Institutes of Health (NIH) U01EB028660.

Dr. Jonathan M. Richardson (pictured below) is a member of the technical staff at MIT Lincoln Laboratory in the Advanced Imaging group. He holds a Ph.D. from Harvard University and has most recently worked in the areas of medical imaging and climate science.

Got Something to Say? We’d Like to Hear It!

Please send your articles, opinions, event re-caps & photos and announcements to The Reflector at:

ieeebostonsection@gmail.com

IEEE Boston MTT/AP-S Chapter – 12:00 PM, Wednesday March 26

MTT-S DML Lecture: "Power Without Pain: High-Power MMIC PA Design, the Pitfalls and How to Avoid Them"

Location: Virtual

Speaker: Dr. Michael Roberg, Qorvo

Register at: https://events.vtools.ieee.org/m/469449

Abstract: This presentation discusses high power monolithic microwave integrated circuit (MMIC) power amplifier (PA) design in Gallium Arsenide (GaAs) and Gallium Nitride (GaN). At a high level, GaN versus GaAs semiconductor technology from the perspective of power amplifier design metrics is analyzed to help determine the relative advantages and disadvantages of each technology. This is followed with an introduction of the most prevalent MMIC design topologies for the bulk of microwave applications which include reactively matched, non-uniform distributed, balanced, push-pull, Doherty and serially combined. Following introduction of the main topologies, the presentation focuses on the potential pitfalls the MMIC designer can encounter with detailed discussion on how to avoid them with the goal of first past design success. The presentation relies on experience from the author's career with over 20 years of experience in the defense and commercial industries as well as academia. MMIC designers will appreciate the candid explanation of the design topologies and pitfalls while non-designers will come away with a good working knowledge of what can be achieved and what to watch out for.

Dr. Michael Roberg (pictured left) received the Ph.D. degree from the University of Colorado at Boulder in 2012. From 2003 to 2009, he was an engineer at Lockheed Martin-MS2 in Moorestown, NJ working on advanced phased array radar systems. From 2012 to 2022 he worked for Qorvo in the High Performance Analog business unit as a MMIC Design Engineering Fellow. In 2021, he received the Outstanding Young Engineer award from MTT-S and in 2022 he won the industry paper competition at IMS in Denver. From 2022-2024 he was an Engineering Fellow at mmTron, Inc. where he focused on MMIC development for millimeter wave systems. Michael re-joined Qorvo as a member of the research organization in 2024 and continues to focus on advanced MMIC development.

Digital Signal Processing (DSP) for Software Radio

Dates & Times: **Course Kick-off/Orientation, 6 - 6:30PM ET, Thursday, February 20**
Live Workshops: 6:00 - 7:30PM ET; Thursdays, Feb. 27, March 6, 13, 20 & 27
First Video Release, Thursday, February 20, additional videos released weekly in advance of that week's live session!

Speaker: **Dan Boschen**
Location: **Zoom**

Register Here Now

Attendees will have access to the recorded session and exercises for two months (until May 27) after the last live session ends!

This is a hands-on course providing pre-recorded lectures that students can watch on their own schedule and an unlimited number of times prior to live Q&A/Workshop sessions with the instructor. Ten 1.5 hour videos released 2 per week while the course is in session will be available for up to two months after the conclusion of the course.

Course Summary This course builds on the IEEE course "DSP for Wireless Communications" also taught by Dan Boschen, further detailing digital signal processing most applicable to practical real-world problems and applications in radio communication systems. Students need not have taken the prior course if they are familiar with fundamental DSP concepts such as the Laplace and Z transform and basic digital filter design principles.

This course brings together core DSP concepts to address signal processing challenges encountered in radios and modems for modern wireless communications. Specific areas covered include carrier and timing recovery, equalization, automatic gain control, and considerations to mitigate the effects of RF and channel distortions such as multipath, phase noise and amplitude/phase offsets.

Dan builds an intuitive understanding of the underlying mathematics through the use of graphics, visual demonstrations, and real-world applications for mixed signal (analog/digital) modern transceivers. This course is applicable to DSP algorithm development with a focus on meeting practical hardware development challenges, rather than a tutorial on implementations with DSP processors.

Now with Jupyter Notebooks! This long-running IEEE Course has been updated to include Jupyter Notebooks which incorporates graphics together with Python simulation code to provide a "take-it-with-you" interactive user experience. No knowledge of Python is required but the notebooks will provide a basic framework for proceeding with further signal processing development using that tools for those that have interest in doing so.

This course will not be teaching Python, but using it for demonstration. A more detailed course on Python itself is covered in a separate IEEE Course routinely taught by Dan titled "Python Applications for Digital Design and Signal Processing".

All set-up information for installation of all tools used will be provided prior to the start of class.

Target Audience: All engineers involved in or interested in signal processing for wireless communications. Students should have either taken the earlier course "DSP for Wireless Communications" or have been sufficiently exposed to basic signal processing concepts such as Fourier, Laplace, and Z-transforms, Digital fil-

ter (FIR/IIR) structures, and representation of complex digital and analog signals in the time and frequency domains. Please contact Dan at boschen@loglin.com if you are uncertain about your background or if you would like more information on the course.

Benefits of Attending/ Goals of Course:
Attendees will gain a strong intuitive understanding of the practical and common signal processing implementations found in modern radio and modem architectures and be able to apply these concepts directly to communications system design.

Topics / Schedule:
Class 1: DSP Review, Radio Architectures, Digital Mapping, Pulse Shaping, Eye Diagrams

Class 2: ADC Receiver, CORDIC Rotator, Digital Down Converters, Numerically Controlled Oscillators

Class 3: Digital Control Loops; Output Power Control, Automatic Gain Control

Class 4: Digital Control Loops; Carrier and Timing Recovery, Sigma Delta Converters

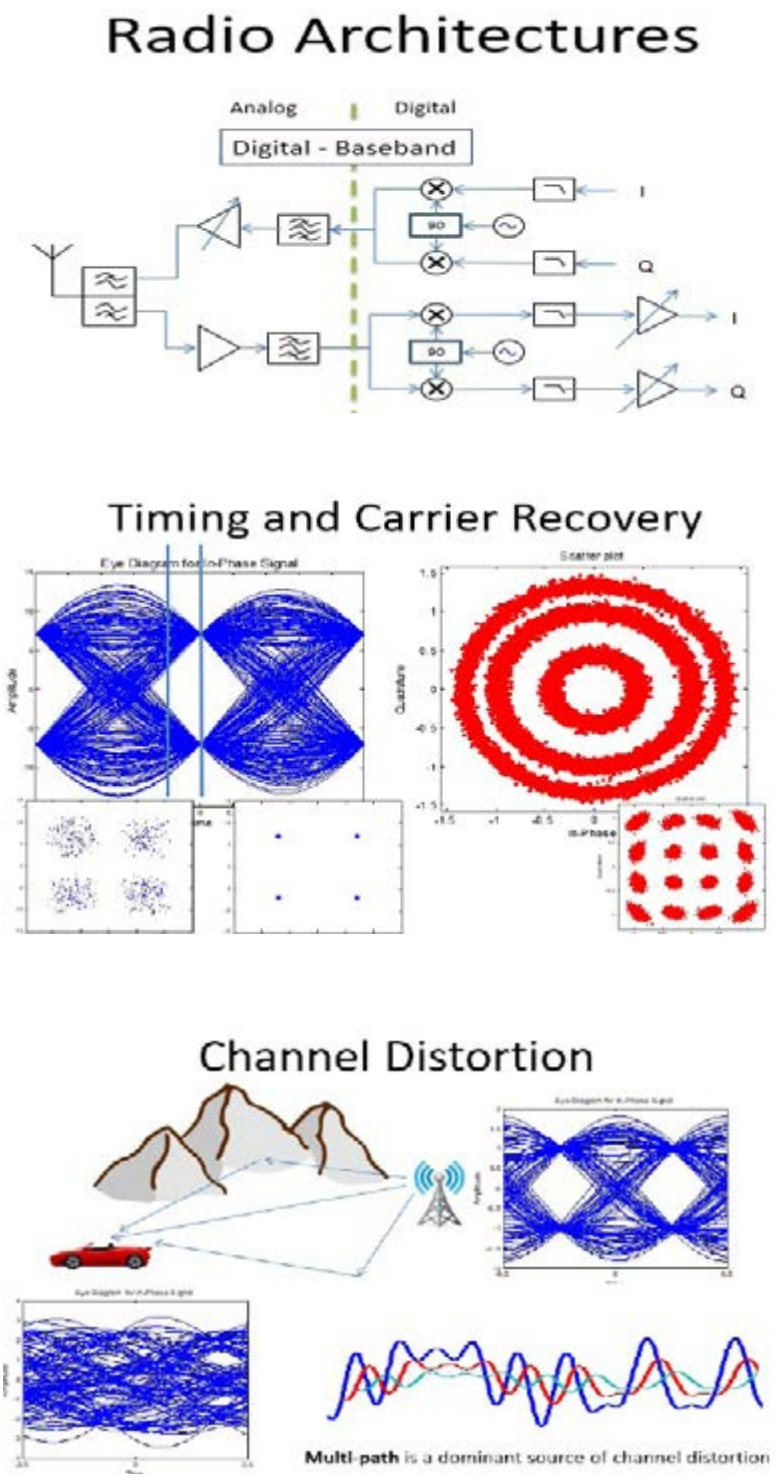
Class 5: RF Signal Impairments, Equalization and Compensation, Linear Feedback Shift Registers

Speaker's Bio:
Dan Boschen has a MS in Communications and Signal Processing from Northeastern University, with over 25 years of experience in system and hardware design for radio transceivers and modems. He has held various positions at Signal Technologies, MITRE, Airvana and Hittite Microwave designing and developing transceiver hardware from baseband to antenna for wireless communications systems and has taught courses on DSP to international audiences for over 15 years. Dan is a contributor to Signal Processing Stack Exchange https://dsp.stackexchange.com/, and is currently at Microchip (formerly Microsemi and Symmetricom) leading design efforts for advanced frequency and time solutions.

For more background information, view Dan's Linked-In page at: http://www.linkedin.com/in/danboschen

Decision (Run/Cancel) Date for this Course is Thursday, February 13, 2025

	By Feb. 6th	After Feb. 6th
IEEE Members	$190	$285
Non-members	$210	$315



https://ieeeboston.org/ieee-boston-section-course-offerings

Introduction to Neural Networks and Deep Learning (Part I)

Web-based Course with live Instructor!

Times & Dates: 8:30AM - 12:30PM ET, Saturday, March 22, 2025

Speaker: CL Kim

Course Format: Live Webinar, 4.0 hours of instruction!

Register Here Now

Series Overview: Neural networks and deep learning currently provides the best solutions to many problems in image recognition, speech recognition, and natural language processing."

Reference book: "Neural Networks and Deep Learning" by Michael Nielsen, http://neuralnetworksanddeeplearning.com/

This Part 1 and the planned Part 2, (to be confirmed) series of courses will teach many of the core concepts behind neural networks and deep learning.

More from the book introduction: We'll learn the core principles behind neural networks and deep learning by attacking a concrete problem: the problem of teaching a computer to recognize handwritten digits. …it can be solved pretty well using a simple neural network, with just a few tens of lines of code, and no special libraries."

"But you don't need to be a professional programmer."

The code provided is in Python, which even if you don't program in Python, should be easy to understand with just a little effort.

Benefits of attending the series:

* Learn the core principles behind neural networks and deep learning.
* See a simple Python program that solves a concrete problem: teaching a computer to recognize a handwritten digit.
* Improve the result through incorporating more and more core ideas about neural networks and deep learning.
* Understand the theory, with worked-out proofs of fundamental equations of backpropagation for those interested.
* Run straightforward Python demo code example.

The demo Python program (updated from version provided in the book) can be downloaded from the speaker's GitHub account. The demo program is run in a Docker container that runs on your Mac, Windows, or Linux personal computer; we plan to provide instructions on doing that in advance of the class.

(That would be one good reason to register early if you plan to attend, in order that you can receive the straightforward instructions and leave yourself with plenty of time to prepare the Git and Docker software that are widely used among software professionals.)

Course Background and Content:

This is a live instructor-led introductory course on Neural Networks and Deep Learning. It is planned to be a two-part series of courses. The first course is complete by itself and covers a feedforward neural network (but not convolutional neural network in Part 1). It will be a pre-requisite for the planned Part 2 second course. The class material is mostly from the highly-regarded and free online book "Neural Networks and Deep Learning" by Michael Nielsen, plus additional material such as

Speaker Background:

CL Kim works in Software Engineering at CarGurus, Inc. He has graduate degrees in Business Administration and in Computer and Information Science from the University of Pennsylvania. He had previously taught for a few years the well-rated IEEE Boston Section class on introduction to the Android platform and API.

Decision (Run/Cancel) Date for this Course is Friday, March 14, 2025

Payment	on/by March 7	After March 7
IEEE Members	$115	$130
Non-members	$135	$150

https://ieeeboston.org/ieee-boston-section-course-offerings

Call for Course Speakers/Organizers

IEEE's core purpose is to foster technological innovation and excellence for the benefit of humanity. The IEEE Boston Section, its dedicated volunteers, and over 8,500 members are committed to fulfilling this core purpose to the local technology community through chapter meetings, conferences, continuing education short courses, and professional and educational activities.

Twice each year a committee of local IEEE volunteers meet to consider course topics for its continuing education program. This committee is comprised of practicing engineers in various technical disciplines. In an effort to expand these course topics for our members and the local technical community at large, the committee is publicizing this CALL FOR COURSE SPEAKERS AND ORGANIZERS.

The Boston Section is one of the largest and most technically divers sections of the IEEE. We have over 20 active chapters and affinity groups.
If you have an expertise that you feel might be of interest to our members, please submit that to our online course proposal form on the section's website (www.ieeeboston.org) and click on the course proposal link (direct course proposal form link is **http://ieeeboston.org/course-proposals/** . Alternatively, you may contact the IEEE Boston Section office at ieeebostonsection@gmail.com or 781 245 5405.

- **Honoraria can be considered for course lecturers**
- Applications oriented, practical focused courses are best (all courses should help attendees expand their knowledge based and help them do their job better after completing a course
- Courses should be no more than 2 full days, or 18 hours for a multi-evening course
- Your course will be publicized to over 10,000 local engineers
- You will be providing a valuable service to your profession
- Previous lecturers include: Dr. Eli Brookner, Dr. Steven Best, Colin Brench, to name a few.

Introduction to Neural Networks and Deep Learning (Part II): Convolutional Neural Networks, Basic Language Modeling

Web-based Course with live Instructor!

Decision (Run/Cancel) Date for this Course is Friday, April 11, 2025

Payment	on/by April 4	After April 4
IEEE Members	$115	$130
Non-members	$135	$150

Register Here Now

Series Overview: Neural networks and deep learning currently provides the best solutions to many problems in image recognition, speech recognition, natural language processing, and generative AI.

The Part 1 class and this Part 2 class will teach many of the core concepts behind neural networks and deep learning, and basic language modeling.

The planned Part 3 class (to be confirmed) will teach a simple Generative Pre-trained Transformer (GPT), based on the seminal Attention is All You Need paper and OpenAI's GPT-2/GPT-3.

Part 2 Description

In the first section, we again use a neural network in teaching a computer to recognize handwritten digits. Here we introduce the convolutional neural network. They are predominantly used in computer vision applications, such as for recognizing objects in images.

The second section, the class introduces basic language modeling, and simple generation of text based on prior learned text, in this case, baby names.

But you don't need to be a professional programmer. The demo code provided is in Python, and should be easy to understand with just a little effort.

Reference:

- Book: Neural Networks and Deep Learning by Michael Nielsen, http://neuralnetworksanddeep-learning.com
- Video Course: Neural Networks: Zero to Hero by Andrej Karpathy, an OpenAI cofounder, https://karpathy.ai/zero-to-hero.html

Benefits of Attending the Series

- Build upon the core principles behind neural networks and deep learning in the Part 1 class to learn about convolutional neural networks.
- See a simple Python program that solves a concrete problem: teaching a computer to recognize a handwritten digit.
- Improve the result through incorporating more and more core ideas about neural networks and deep learning.
- Understand basic language modeling.
- Implement a simple language model that generates baby names from existing names.
- Get introduced to the popular PyTorch library.
- Run straightforward Python demo code examples.

Description Continued on next Page

Course Background and Content:

This is a live instructor-led introductory course on Neural Networks and Deep Learning. It is planned to be a three-part series of classes.

The Section 1, Part 2, class material is mostly from the same highly-regarded and free online book used for the Part 1 class: Neural Networks and Deep Learning by Michael Nielsen. We add some additional material such as introducing the Residual or Skip connection in a Residual block, which is commonly adopted in many types of deep neural networks.

The Section 2, Part 2, class material is from the sixth video: Building makemore Part 5: Building a WaveNet from the above referenced truly amazing video course series by one of OpenAI's co-founders, Andrej Karpathy.

Part 2 Class Outline:

Section 1 Convolutional Neural Networks.

- Simple (Python) Network to classify a handwritten digit
- Local receptive fields
- Feature map: Shared weights, bias
- Pooling
- Demo code using Theano library for learning only
- Automatic gradient/backprop calculation
- Weight initialization
- Quick introduction to PyTorch library
- AlexNet: Example of a Convolutional Neural Network architecture
- Residual or Skip connection

Section 2 Basic Language Modeling.

- Vocabulary (character-level)
- Block or Context length - # of tokens (characters) considered in predicting next one
- Datasets for training, validation, test
- Multi-layer neural network
- Embedding layer, Flatten layer, Linear layer, BatchNorm1d layer, Tanh activation
- Improve Flatten layer with a hierarchical architecture
- PyTorch's cross_entropy method to get loss
- Automatic gradient calculation with Pytorch's loss.backward method
- Stochastic Gradient Descent to learn/update parameters

Part 2 class Pre-requisites:

The material in the Part 1 class, which requires some basic familiarity with multivariable calculus and matrix algebra, but nothing advanced. Basic familiarity with Python or similar computer language.

https://ieeeboston.org/ieee-boston-section-course-offerings

Share Your Ideas in *The Reflector*

We invite you to contribute technical, professional development and general interest articles to *The Reflector*. These will supplement the existing material already in our publication.

Technical submissions should be of reasonable technical depth and include graphics and, if needed, any supporting files. The length is flexible; however, a four to five page limit should be used as a guide. An appropriate guide may be a technical paper in a conference proceeding rather than one in an IEEE journal or transaction.

Professional development or general interest articles should have broad applicability to the engineering community and should not explicitly promote services for which a fee or payment is required. A maximum length of two to three pages would be best.

To ensure quality, technical submissions will be reviewed by the appropriate technical area(s). Professional/interest articles will be reviewed by the Publications Committee for suitability.The author will be notified of the reviewers' decision.

The Reflector is published the first of each month. The target submission deadline for the articles should be one month before the issue date.

Submit articles to: ieeebostonsection@gmail.com

Python Applications for Digital Design and Signal Processing

Dates & Times: **Course Kick-off/Orientation, 6 - 6:30PM ET, Thursday, May 1**
Live Workshops: 6:00 - 7:30PM ET; Thursdays, May 8, 15, 22 and 29
First Video Release, Thursday, May 1, 2025, additional videos released weekly in advance of that week's live session!

Speaker: **Dan Boschen**
Location: **Zoom**

This is a hands-on course combining pre-recorded lectures with live Q&A and workshop sessions in the popular and powerful open-source Python programming language.
Course Information will be distributed on Thursday, May 1 in advance of and in preparation for the first live workshop session. A live orientation session will be held on February 29. Attendees will have access to the recorded session and exercises for two months (until May 20, 2025) after the last live session ends!

Pre-Recorded Videos: The course format includes pre-recorded video lectures that students can watch on their own schedule, and an unlimited number of times, prior to live Q&A workshop sessions on Zoom with the instructor. The videos will also be available to the students for viewing for up to two months after the conclusion of the course.

Overview: Dan provides simple, straight-forward navigation through the multiple configurations and options, providing a best-practices approach for quickly getting up to speed using Python for modelling and analysis for applications in signal processing and digital design verification. Students will be using the Anaconda distribution, which combines Python with the most popular data science applications, and Jupyter Notebooks for a rich, interactive experience.

The course begins with basic Python data structures and constructs, including key "Pythonic" concepts, followed by an overview and use of popular packages for scientific computing enabling rapid prototyping for system design.

During the course students will create example designs including a sigma delta converter and direct digital synthesizer both in floating point and fixed point. This will include considerations for cycle and bit accurate models useful for digital design verification (FPGA/ASIC), while bringing forward the signal processing tools for frequency and time domain analysis.

Jupyter Notebooks: This course makes extensive use of Jupyter Notebooks which combines running Python code with interactive plots and graphics for a rich user experience. Jupyter Notebooks is an open-source web-based application (that can be run locally) that allows users to create and share visually appealing documents containing code, graphics, visualizations and interactive plots. Students will be able to interact with the notebook contents and use "take-it-with-you" results for future applications in signal processing.

Target Audience: This course is targeted toward users with little to no prior experience in Python, however familiarity with other modern programming languages and an exposure to object-oriented constructs is very helpful. Students should be comfortable with basic signal processing concepts in the frequency and time domain. Familiarity with Matlab or Octave is not required, but the equivalent operations in Python using the NumPy package will be provided for those students that do currently use Matlab and/or Octave for signal processing applications.

Benefits of Attending / Goals of Course: Attendees will gain an overall appreciation of using Python and quickly get up to speed in best practice use of Python.

Topics / Schedule:

Pre-recorded lectures (3 hours each) will be distributed Friday prior to each week's workshop dates. Workshop/ Q&A Sessions are 6 - 7:30PM on the dates listed below:

Kick-off / Orientation: May 1

Class 1 May 8

Topic 1: Intro to Jupyter Notebooks, the Spyder IDE and the course design examples. Core Python constructs.

Class 2 May 15

Topic 2: Core Python constructs; iterators, functions, reading writing data files.

Class 3 May 22

Topic 3: Signal processing simulation with popular packages including NumPy, SciPy, and Matplotlib.

Class 4 May 29

Topic 4: Bit/cycle accurate modelling and analysis using the design examples and simulation packages

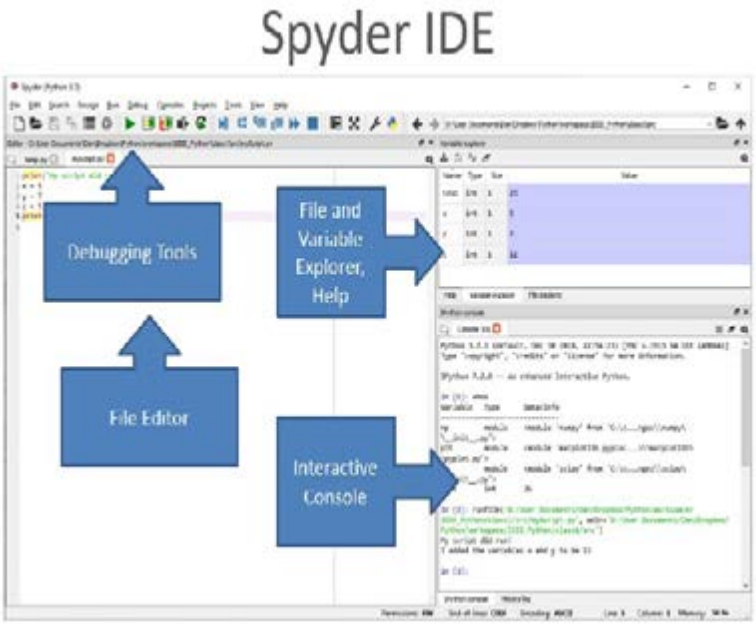
Speaker's Bio: Dan Boschen has a MS in Communications and Signal Processing from Northeastern University, with over 25 years of experience in system and hardware design for radio transceivers and modems. He has held various positions at Signal Technologies, MITRE, Airvana and Hittite Microwave designing and developing transceiver hardware from baseband to antenna for wireless communications systems and has taught courses on DSP to international audiences for over 15 years. Dan is a contributor to Signal Processing Stack Exchange https://dsp.stackexchange.com/, and is currently at Microchip (formerly Microsemi and Symmetricom) leading design efforts for advanced frequency and time solutions.

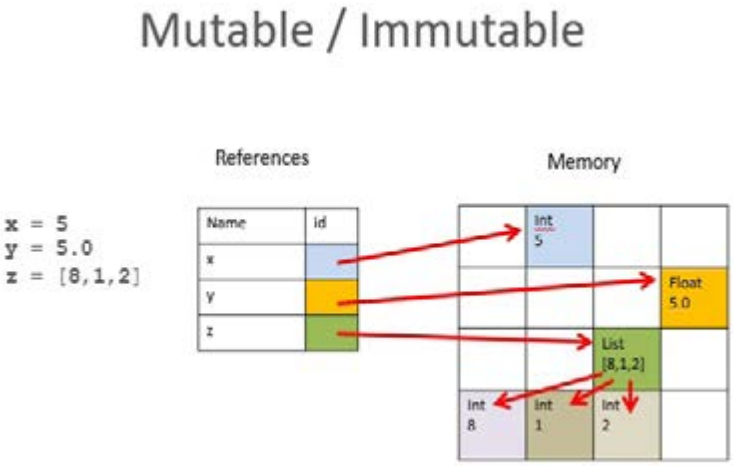
For more background information, please view Dan's Linked-In page (https://www.linkedin.com/in/danboschen/)

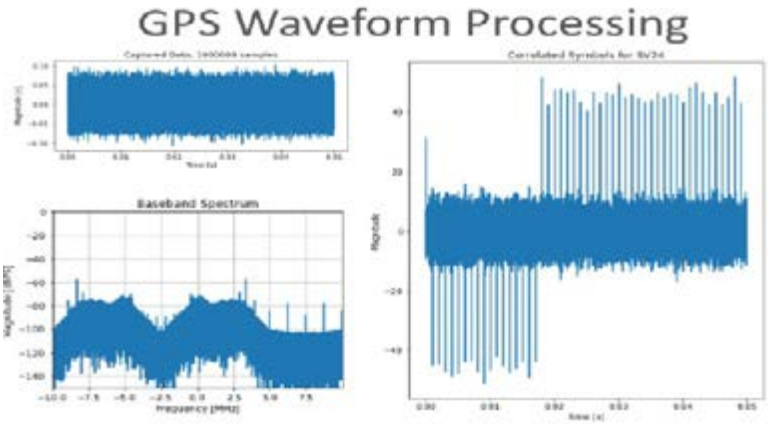
Registration is open through the last live workshop date. Live workshops are recorded for later use.

Decision (Run/Cancel) Date for this Course is Thursday, April 24, 2025

Payment On/by	April 18	After April 18
IEEE Members	$190	$285
Non-members	$210	$315







https://ieeeboston.org/ieee-boston-section-course-offerings

DSP for Wireless Communications

Dates & Times: **Course Kick-off/Orientation, 6 - 6:30PM ET, Thursday, July 3**
Live Workshops: 6:00 - 7:30PM ET; Thursdays, July 10, 17, 24, 31 & Aug. 7
First Video Release, Thursday, July 3, 2025 additional videos released weekly in advance of that week's live session!

Speaker: **Dan Boschen**
Location: **Zoom**

New Format Combining Live Workshops with Pre-recorded Video - This is a hands-on course providing pre-recorded lectures that students can watch **on their own schedule** and an **unlimited number of times** prior to live Q&A/Workshop sessions with the instructor. Ten 1.5 hour videos released 2 per week while the course is in session will be available for up to two months after the conclusion of the course...until July 23, 2024

Course Summary

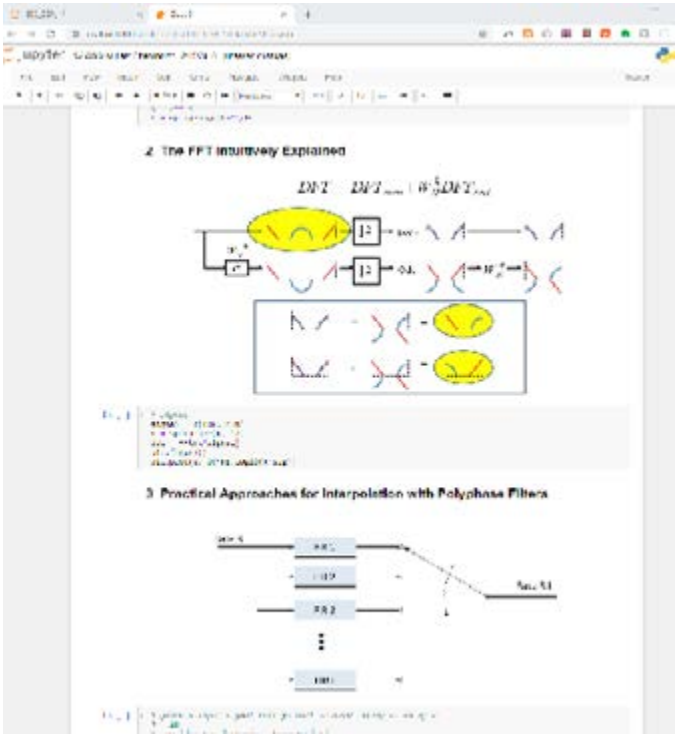
This course is a fresh view of the fundamental and practical concepts of digital signal processing applicable to the design of mixed signal design with A/D conversion, digital filters, operations with the FFT, and multi-rate signal processing. This course will build an intuitive understanding of the underlying mathematics through the use of graphics, visual demonstrations, and applications in GPS and mixed signal (analog/digital) modern transceivers. This course is applicable to DSP algorithm development with a focus on meeting practical hardware development challenges in both the analog and digital domains, and not a tutorial on working with specific DSP processor hardware.

Now with Jupyter Notebooks!

This long-running IEEE Course has been updated to include Jupyter Notebooks which incorporates graphics together with Python simulation code to provide a "take-it-with-you" interactive user experience. No knowledge of Python is required but the notebooks will provide a basic framework for proceeding with further signal processing development using that tools for those that have interest in doing so.

This course will not be teaching Python, but using it for demonstration. A more detailed course on Python itself is covered in a separate IEEE Course "Python Applications for Digital Design and Signal Processing".

Students will be encouraged but not required to load all the Python tools needed, and all set-up information for installation will be provided prior to the start of class.



Target Audience:

All engineers involved in or interested in signal processing applications. Engineers with significant experience with DSP will also appreciate this opportunity for an in-depth review of the fundamental DSP concepts from a different perspective than that given in a traditional introductory DSP course.

Benefits of Attending/ Goals of Course:

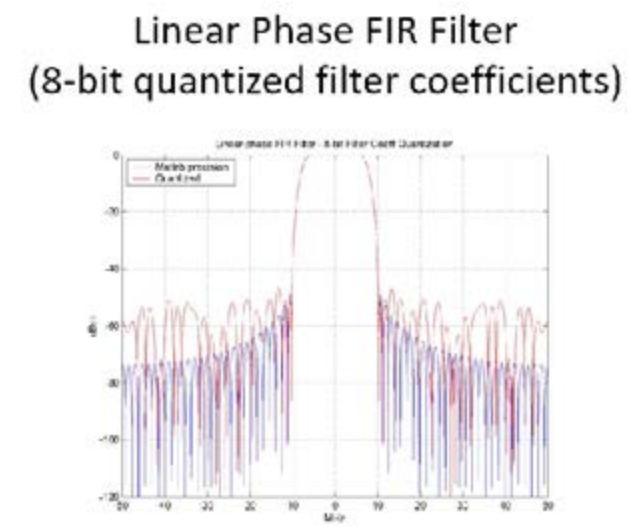
Attendees will build a stronger intuitive understanding of the fundamental signal processing concepts involved with digital filtering and mixed signal analog and digital design. With this, attendees will be able to implement more creative and efficient signal processing architectures in both the analog and digital domains. The knowledge gained from this course will have immediate practical value for any work in the signal processing field.

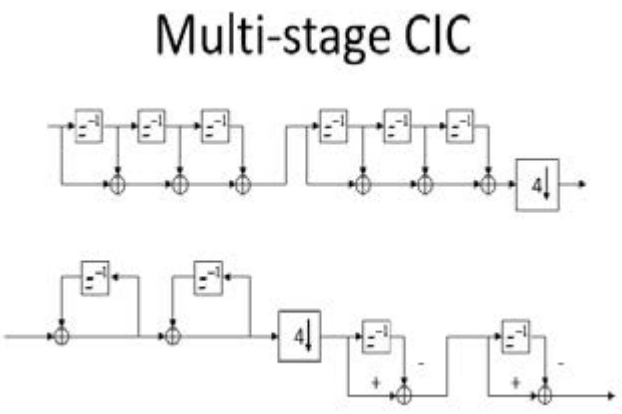
Topics / Schedule:

Class 1: Correlation, Fourier Transform, Laplace Transform

Class 2: Sampling and A/D Conversion, Z –transform, D/A Conversion

Class 3: IIR and FIR Digital filters, Direct Fourier Transform





Class 4: Windowing, Digital Filter Design, Fixed Point vs Floating Point

Class 5: Fast Fourier Transform, Multi-rate Signal Processing, Multi-rate Filters

Speaker's Bio:

Dan Boschen has a MS in Communications and Signal Processing from Northeastern University, with over 25 years of experience in system and hardware design for radio transceivers and modems. He has held various positions at Signal Technologies, MITRE, Airvana and Hittite Microwave designing and developing transceiver hardware from baseband to antenna for wireless communications systems. Dan is currently at Microchip (formerly Microsemi and Symmetricom) leading design efforts for advanced frequency and time solutions.

For more background information, please view Dan's Linked-In page at:
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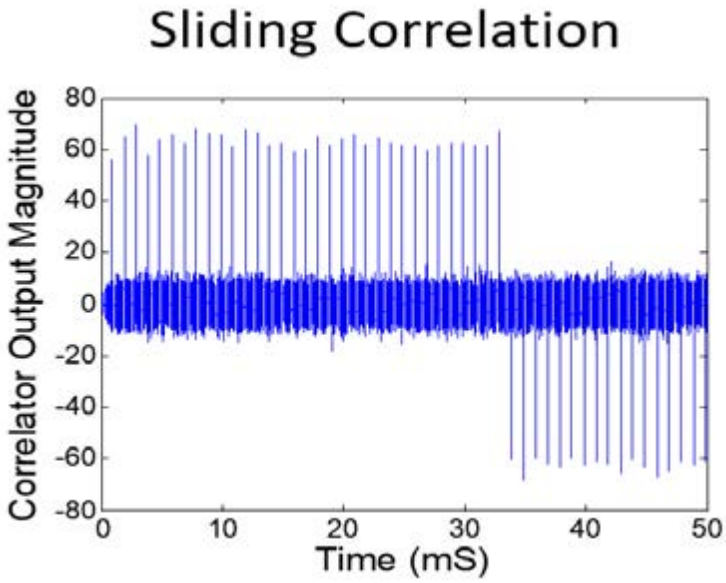

Decision (Run/Cancel) Date for this Course is Friday, June 27, 2025

Payment	By June 19	After June 19
IEEE Members	$190	$285
Non-members	$210	$315

https://ieeeboston.org/ieee-boston-section-course-offerings

Consumer Technology Society Call for Volunteers!

We are currently looking for volunteers who would be interested in pushing forward the mission of the Consumer Technology (CT-S), Boston Chapter. The chapter is looking for volunteers to help organize chapter meetings and help meet the needs of the local CT-S member needs.

The Boston Section is organizing chapters into groups of similar technical interest areas to pool their resources for easier and better chapter collaboration in planning the chapter events.

If you have interest in volunteering for a chapter leadership position or are interested in learning more about what these volunteer positions may entail, please send an email to Karen Safina in the IEEE Boston Section office at, ieee-bostonsection@gmail.com

Engineering in Medicine & Biology Society Call for Volunteers!

We are currently looking for volunteers who would be interested in pushing forward the mission of the Engineering in Medicine & Biology Society (EMBS), Boston Chapter. The EMBS - Boston Chapter was recently approved and we're looking to make a significant impact in the area of Biomedicine, Bioengineering, and Biotechnology in the region. The chapter is looking for volunteers to help organize chapter meetings and help meet the needs of the local EMBS members.

The Boston Section is organizing chapters into groups of similar technical interest areas to pool their resources for easier and better chapter collaboration in planning the chapter events.

If you have interest in volunteering for a chapter leadership position or are interested in learning more about what these volunteer positions may entail, please send an email to Karen Safina in the IEEE Boston Section office at, ieee-bostonsection@gmail.com.

Aseem Singh, Marie Tupaj, Co-Chairs, Boston EMBS Chapter

IEEE Strategic Plan

2025-2030

OUR MISSION

We foster technological innovation and excellence for the benefit of humanity.

OUR VISION

We will be essential to the global technical community and to technical professionals everywhere, and be universally recognized for the contributions of technology and of technical professionals in improving global conditions.

CORE VALUES

- Growth & Nurturing
- Trust
- Partnership
- Integrity in Action
- Global Community Building
- Service to Humanity

OUR GOALS

Advance science and technology as a leading trusted source of information for research, development, standards, and public policy

Drive technological innovation while promoting scientific integrity and the ethical development and use of technology

Provide opportunities for technology-related interdisciplinary collaboration, research, and knowledge sharing across industry, academia, and government

Inspire intellectual curiosity and support discovery and invention to engage the next generation of technology innovators

Expand public awareness of the significant role that engineering, science, and technology play across the globe

Empower technology professionals in their careers through ongoing education, mentoring, networking, and lifelong engagement

IEEE will foster a collaborative environment that is open, inclusive, and free of bias and will continue to sustain the strength, reach, and vitality of our organization for future generations.

www.ieee.org/strategic-plan

Approved by the IEEE Board of Directors, November 2024

IEEE
Advancing Technology for Humanity

IEEE Boston Section Online Courses:

(Students have 180 day access to all online, self-paced courses)

Electronic Reliability Tutorial Series
Full course description and registration at ,
http://ieeeboston.org/electronic-reliability/

Introduction to Embedded Linux Part I
Full course description and registration at ,
http://ieeeboston.org/introduction-to-embedded-linux-part-i-el201-online-course/

Embedded Linux Optimization - Tools and Techniques
Full course description and registration at ,
http://ieeeboston.org/embedded-linux-optimization-tools-techniques-line-course/

Embedded Linux Board Support Packages and Device Drivers
Full course description and registration at ,
http://ieeeboston.org/embedded-linux-bsps-device-drivers-line-course/

Software Development for Medical Device Manufacturers
Full course description and registration at ,
http://ieeeboston.org/software-development-medical-device-manufacturers-line-course/

Fundamental Mathematics Concepts Relating to Electromagnetics
Full course description and registration at ,
http://ieeeboston.org/fundamental-mathematics-concepts-relating-electromagnetics-line-course/

Reliability Engineering for the Business World
Full course description and registration at ,
http://ieeeboston.org/reliability-engineering-business-world-line-course/

Design Thinking for Today's Technical Work
http://ieeeboston.org/design-thinking-technical-work-line-course/

Fundamentals of Real-Time Operating Systems
http://ieeeboston.org/fundamentals-of-real-time-operating-systems-rt201-on-line-course/

Reliability Tutorial Series: Electronic Failure Mechanisms
https://ieeeboston.org/event/ieee-ansys-reliability-tutorial-series-electronic-reliability/?instance_id=3635

Reliability Tutorial Series – Accelerated Life Testing for Electronics Reliability
https://ieeeboston.org/event/ieee-ansys-reliability-tutorial-series/?instance_id=3634

IEEE Boston Section Volunteers Wanted!

Are you passionate about technology and eager to contribute to the advancement of your field? The IEEE Boston Section is excited to announce a call for volunteers to join our dynamic team of professionals and enthusiasts. By becoming a volunteer, you'll have the opportunity to collaborate with like-minded individuals, develop new skills, and make a meaningful impact on the local technology community.

About IEEE Boston Section:

The IEEE Boston Section is a thriving community of engineers, researchers, students, and industry professionals dedicated to promoting technological innovation and knowledge sharing. Our section hosts a variety of events, workshops, seminars, and conferences throughout the year, providing members with opportunities to learn, network, and stay updated on the latest developments in their fields.

Volunteer Opportunities:

We are currently seeking volunteers to help on the following committees:

The Fellow and Awards Committee - activities include recommending qualified members of the Section for advancement to Fellow grade and for receipt of the various IEEE (IEEE/Region/MGA/Section) awards. Identifying and building a database of the various IEEE awards available for nomination and searching out qualified candidates, for preparing the necessary written recommendations, and for assembling all required supporting documentation and submit its recommendations directly to the appropriate IEEE body.
Time Commitment: Meets 4 times a year for 1 – 2 hours per meeting (virtual or in person)

Local Conferences Committee - activities include identifying timely topical areas for conference development. Identify champions of these conferences to run the identified conference organizing committees. The section local conference committee is not charged with organizing and executing individual conferences.
Time Commitment: Meets 4 times per year 1 – 2 hours per meeting (virtual or in person)

Professional Development & Education Committee - activities include identifying topics, speakers, and/or organizers for appropriate technical lecture series or seminars. The subject matter should be timely, of interest to a large segment of the membership, and well organized with regard to speakers and written subject matter.
Time Commitment: meets 4 times per year, 1 – 2 hours per meeting (virtual or in person)

The Membership Development Committee - activities include actively promoting membership in the IEEE and shall encourage members to advance to the highest grade of membership for which they are qualified. To these ends this committee shall include wide representation within the Section territory, shall maintain lists of prospects and members qualified for advancement, and shall provide information and assistance to preparing applications.
Time Commitment: meets 4 times per year, 1 – 2 hours per meeting (virtual or in person)

Student Activities Committee - activities include attracting a broad and diverse group of undergraduate and graduate students to IEEE and to engage them in activities that promote their own professional development as well as the ongoing growth of IEEE. The Student Activities Committee shall include among its members the IEEE Counselors at the universities, colleges, and technical institutes that lie within the Section territory. It shall be responsible for liaison with the Student Branches at these institutions and advise the Executive Committee on all other matters affecting the Student Members of the Section.
Time Commitment: meets 4 times per year, 1 – 2 hours per meeting (virtual or in person)

Young Professionals Affinity Group - activities include organizing programs, and initiatives aimed to address the needs of early-career professionals pursuing technology-related careers in engineering, business, management, marketing, and law. This committee is committed to helping young professionals evaluate their career goals, polish their professional image, and create the building blocks of a lifelong and diverse professional network.
Time Commitment: meets 4 times per year, 1 – 2 hours per meeting (virtual or in person)

Benefits of Volunteering:

Volunteering with IEEE Boston Section offers numerous benefits, including:

- Networking opportunities with professionals in your field.
- Skill development and enhancement through hands-on experience.
- Contribution to the local technology community and its growth.
- Access to cutting-edge information and discussions.

How to Get Involved:

If you're enthusiastic about technology and want to make a difference, we invite you to join us as a volunteer. To express your interest and learn more about specific roles, please visit our website and fill out the volunteer application form. Our team will get in touch with you to discuss opportunities that align with your interests and skills.

Thank you for considering this opportunity to contribute to the IEEE Boston Section. Your dedication and passion are what drive the success of our community and its impact on the world of technology.

Volunteer Here!

https://ieeeboston.org/volunteer/