June 2021

Welcome Message from Editor and Team!

Happy Summer!

We welcome you to June issue of IEEE Newsletter, Toronto section.

In this issue, enjoy reading article “Artificial Intelligence vs Computational Intelligence”. **(Page 4)**

You will also come to know about recent applied research projects, please visit Research Direction page. **(Page 7)**

Meet Bruno Di Stefano; in our IEEE supporters section. Enjoy and appreciate his contributions to IEEE.

By launching this newsletter, we intend to cover IEEE achievements and success stories specific to the Toronto area.

If you have any questions, suggestions, or concerns, please address them to the editor; Fatima Hussain at fatima.hussain@ryerson.ca. We hope to hear from you, and we welcome your feedback!

Meet Our Distinguished IEEE Members

Bruno Di Stefano

Bruno Di Stefano is a Professional Engineer (PEO), Life Senior Member of IEEE, Fellow of the Engineering Institute of Canada, Fellow of Engineers Canada, with more than 45 years of professional experience. He practiced in electronics, computer, and software engineering, in product development and management consulting, and lectured part time at

university and industrial course level, publishing technical and scientific peer reviewed papers. Bruno has been and continues to be active with IEEE and providing reviews for various journals & conferences.

Bruno Di Stefano graduated from “Sapienza – Università di Roma”, Italy, with a “Laurea” degree “Dottore in Ingegneria Elettronica”, a 5 year degree followed by a time open ended research thesis (in his case on “Technological Design of Television Transmitters” frequenting for 18 months an R&D office of R.A.I., the Italian State Broadcasting Corporation). In 1975-1977, Bruno designed UHF & radar microwaves micro-strip circuits & software to automate such design (contractually limited jobs in Italy, Germany, The Netherlands). He passed the Italian professional engineering licence exams.

In 1978 Bruno Di Stefano moved to Canada to work with AES Data Ltd as a computer hardware designer (e.g. data communication, floppy & hard drives, magnetic cards & tapes, video controllers, and printers during a short stint at Delphax Systems). The technology was SSI & MSI (1978-1980), LSI & VLSI (1980-1982), and both loosely and tightly coupled multi-cpu (after 1982).

In 1981 Bruno Di Stefano founded Nuptek Systems Ltd., a federally incorporated consulting company operating first as an engineering company under Bruno’s PEO license and then holding a PEO CofA (a Certificate of Authorization) to provide engineering services to the public. Nuptek specialized in hardware & software, real-time embedded systems, OOA/OOD, and C/C++. By collaborating with other companies, it provided product development & turn-key solutions requiring also knowledge of other fields of engineering. Currently, the company no longer offers engineering services to the public but conducts independent research.

Bruno Di Stefano has published several technical & peer reviewed papers and book reviews. His current research interests include computational intelligence, fuzzy logic, cognitive agents, and design methods. He is a reviewer for IEEE conferences & journals, since 2013 for ICAART, the International Conference on Agents and Artificial Intelligence, and co-eddied several international conference proceeding volumes.

From 1986 to 2003, Bruno has taught in the Professional Development Program of the Faculty of Applied Science and Engineering at the University of Toronto. Previously he was an instructor with Ryerson University. He also delivered courses for the University Of Toronto (School of Continuing Studies), Technical University Of Nova Scotia, the IEEE, CAIMS (Canadian Applied and Industrial Mathematics Society), the Canadian High Technology Show, EPIC (Educational Program Innovations Center), and many in-house courses for several clients of Nuptek Systems Ltd.

Bruno Di Stefano has been active with the IEEE since 1979, within the Toronto Section (Society Chapter Chair of various Societies, Educational Activities Chair, History Chair, Section Treasurer, Section Secretary, Section Vice-Chair, Section Chair), IEEE Central Canada Council, IEEE Canada, and many organizing committees of IEEE Conferences. Since 2007, he is active with the IEEE Computational Intelligence Society. He co-authored IEEE 1855-2016, i.e. “IEEE Standard for Fuzzy Markup Language”. His awards from IEEE include: a Toronto Section Scholarship named in his honour (2003) (one of three in the 100 years of the IEEE Toronto Section history); IEEE Third Millennium Medal (2000); IEEE Central Canada Council Award (1998), the W.S. Read Outstanding Service Award (2008).

Since 1992 Bruno Di Stefano has been active with PEO in his chapter, in the Professional Practice Committee, as Chair of the Engineering Disciplines Task Group (to study regulatory issues pertaining to non-traditional engineering disciplines and in particular software engineering). He co-authored PEO guidelines for “Professional Engineers Acting as Independent Contractors” and for “Professional Engineers Acting as Contract Employees”. In 1999-2000 Bruno represented PEO as a member of the CEHRB (Canadian Engineering Human Resources Board, one of the boards of CCPE, i.e. Canadian Council of Professional Engineers, the Canadian national coordinating body for provincial and territorial licensing authorities) which conducted labour market surveys, provided statistical information and monitored supply & demand of engineers & engineering.

Artificial Intelligence vs Computational Intelligence

Bruno Di Stefano

One can hardly scan through newspapers and magazines without finding the term “Artificial Intelligence” (AI). For instance, The Economist, a very respected and reliable magazine focused on world events, politics and business, but also on science and technology, has published plenty of in depth articles and special reports on various aspects of AI and its impact on society and the economy. Tracking the frequency of searches for the topic “Artificial Intelligence” with Google Trends, one can see an increase of 33% since 2004. Google Books Ngram Viewer provides similar results about hard printed material. Thus, IEEE members may be surprised noticing that in spite of the fact that IEEE has 39 technical Societies, it does not have an “Artificial Intelligence Society”. How is it possible?

Looking closer, one can see that IEEE has a “Computational Intelligence” (CI) Society (IEEE CIS). It sounds very similar… and some members even claim that it is the same thing. Is it?

AI and CI have a similar long-term goal: to achieve “general intelligence”, i.e. the intelligence of a machine that could perform any intellectual task that a human being can. However, according to James C. Bezdek, a scientist of foundational importance for CI, but who has contributed to both, AI and CI, AI is based on hard computing methods (i.e. computing based on crisp binary-based computation), while CI is based on soft computing methods (i.e. neural network, fuzzy logic, and genetic algorithm, according to an original definition by Lotfi Zadeh).

Given the absence of an IEEE AI Society, IEEE CIS is the society that ends dealing with the majority of AI matters within IEEE, including matters with very strong societal implications, as, for instance with Explainable AI.

Explainable AI (XAI) is AI where the results of a solution can be understood by humans. This is in contrast with “black box” AI in machine learning where even its designers cannot explain why an AI algorithm arrived to a specific decision. IEEE CIS has setup a working group to develop an

IEEE standard on XAI: **P2976 –** "**Standard for XAI – eXplainable Artificial Intelligence – for Achieving Clarity and Interoperability of AI Systems Design**". The purpose of this standard is to enable "*engineers and scientists developing AI systems to design systems with improved interoperability, supporting the export and import of AI systems and solutions from one implementation to another*."

The aim is to provide researchers, developers and designers of AI (including machine learning, rule-based, neural network and other) systems and industrial applications with a unified and high-level methodology for classification of their products as partially or fully explainable. This standard includes an "XML Schema" describing the requirements and constraints that have to be satisfied.The rationale of the XAI effort is that there is a social "*right to explanation*". End users need to be able to trust that the AI algorithm is making good decisions.

What is the "right to explanation"? We all assume that we have a right to know why a decision about us was made, particularly when such decision is negative and goes against our expectations. For instance, a student wants to know why his/her test was evaluated with a lower grade than he/she expected. A candidate is entitled to know why he/she was not hired. An applicant is entitled to know why a mortgage application, a rent application, or an insurance claim, etc. were denied. Everybody expects to know why he/she got a certain credit In summary, by standardizing on a common EHR format that can convert selected data to and from other EHR formats, this enables interoperability with multiple EHR services to provide a holistic view of a patient's healthcare data. This, in turn, allows the use of a common blockchain to record and apply a patient's privacy decisions to clinicians viewing their data. Healthcare services retain the freedom to implement privacy regulations in their own manner. However, it may be beneficial for the services to access the blockchain as a source of the patient's healthcare data privacy decisions and permissions. The advantage to the patient is that they can edit and maintain their privacy decisions in one system knowing that it will be applied consistently throughout the healthcare jurisdiction. The PCPS is a key component in our work that combines blockchain, semantic, and graph database technologies to allow clinicians to quickly obtain the right patient data at the right time to improve treatment of the patient at lower cost.

This "right to explanation" is at the basis of the ability to improve "next time" and to avoid the negative outcome.

In an age when job applications & resumes are pre-screened by computer, when insurance rates are set by by computer, when behavioral risks are assessed by computer, those being assessed are entitled to know the rationale of the decision making process. In short , in the words of the Wikipedia, *"In the regulation of algorithms, particularly artificial intelligence and its subfield of machine learning, a right to explanation (or right to an explanation) is a right to be given an explanation for an output of the algorithm. Such rights primarily refer to individual rights to be given an explanation for decisions that significantly affect an individual, particularly legally or financially."*

IEEE is not alone in working toward the goal of XAI. For instance:

1. The National Institute of Standards and Technology (NIST) published (August 2020) draft document NISTIR 8312 with the title "**Four Principles of Explainable Artificial Intelligence**". It has an emphasis on ethics and human side and is less technical than the planned focus of IEEE P2976.

2. The World Wide Web Consortium (W3C) published on 31 Oct 2018 an online post in its AI Knowledge Representation (AI KR) Community group called "**Toward a Web Standard for Explainable AI**?". It is not a standard on its own, but it is important because it indicates interest in the W3C towards this topic.

P2976 is just starting its work, which is expected to reach full completion in 2025. However, there will be many opportunities to follow the progress of this working group as various reports and standard drafts will be issued along the way. Both IEEE CIS and IEEE SA will circulate information as it becomes available.

Student Research: Capstone Projects Showcase-Sheridan College

Ameera Al-Karkhi

Each year, over 35 student teams work together to design, build and showcase their projects that include advanced technologies such as Additive Manufacturing, Energy, Robotics, Automation, the Internet of Things and Advanced Electrical Devices. The Capstone projects provides the students with Hands-on learning transferable from the classroom, lab or workshop to the workplace. In order to prepare them to respond to the rapidly evolving field of Information and Communication Technology. They experience hands-on learning in critical topics like information systems security, Robotics and automation, engineering design, mobile and wireless technology, web development, computer programming, software engineering, interactive media management, database development and internet communications technology.

For each field, Sheridan college School of Mechanical and Electrical Engineering Technology (MEET), nominated three winners from each field, for example, the winners from the last capstone showcase in the Electrical and Computer Engineering, the students designed and implemented a stand-alone smart wearable device (Guide me watch) to help those dealing with memory related issues in addition to a mobile application. The idea was originated from the lack of products specifically for Alzheimer patients. There are products that are useful such as GPS trackers, Fitbits, etc. Therefore, creating one product with all the tools is the conclusion that the students came to, and the best form factor would be a watch because having it wearable ensure users will not forget and leave it somewhere. The final product is a Smart watch that can track user's location, heartrate, and time. It could send GPS and heartrate data over the air to a smartphone. Write and read data from user input. Able to send and receive messages from a smartphone over the air. Touchscreen capability to interface with watch's functions.

Another project in which the students proposed and implemented the next evolution in alarm intrusion detection systems. They designed and developed an alarm system that would be effective in rural areas and large pieces of real estate such as the ones found in Northern Ontario, or outside of Canada, such as many rural parts of USA. Examining the traditional alarm

systems out on the market right now, they are mostly made to perform in real estate that monitor just the house, and any small backyard/front yards. These systems cannot perform as effectively in large pieces of land that are typically found in farmhouses or other rural properties, mainly due to the constraints of various parts and equipment needed to have a single home security system functioning. The proposed system, known as the Raptors Alarm Intrusion Detection System (R.A.I.D.S) was tailormade to take advantage of such areas, accounting for the vast open space, differing weather conditions, and state of the art technology. The system consists of two main components: static components, and the drone dispatch system. The static components are top-tier quality CCTV cameras, motion sensing spotlights, and triggers that is placed around the internals, and perimeters of the property. The drone dispatch consists of a security drone, that will be constantly active to keep alert for any incoming danger entering the property, equipped with intercom systems and cameras of its own to record the activity and have emergency services ready to call at a moment's notice. All components of the system will be programmable according to the user and will be constantly connected via internet 24/7. All of these components combined make for an alarm system that can truly keep a home in rural areas secured more than any system out there.

The mentioned projects are implemented as part of their final year capstone projects in the fall under the capstone projects category. Sheridan college is proud of all Mechanical and Electrical Engineering Technology Capstone projects students for their accomplishment, hard work and dedication to develop innovative solutions for their industrial problems. They strive to become one of the foremost engineering and applied science centers in Canada through high-quality and innovative programs, value-added research, excellence in education, and exceptional students and graduates who are prepared to be productive professionals and leaders of tomorrow.

Get Involved with Us!

IEEE Toronto section is looking forward to hearing from you. your contributions are welcome to this monthly newsletter. We invite our members to share and submit:

- Short Story (about IEEE members, WIE members)
- News items and Affinity group reports
- Technical Articles/Blogs (Brief discussions of cutting edge research, new technological tools, topics of your choice)

Submission

Articles should be submitted in Word format. Word count for News items, Affinity group reports is 50 to 200 words and for blogs/ articles is 500 to 800 words.

Editor: Fatima Hussain

Contact: fatima.hussain@ieee.org

Coordinator: Ameera Karkhi

Contact: ameera.karkhi@gmail.com

Webmaster: Melanie Soliven

Contact: msoliven@ieee.org