# FEEDFORWARD

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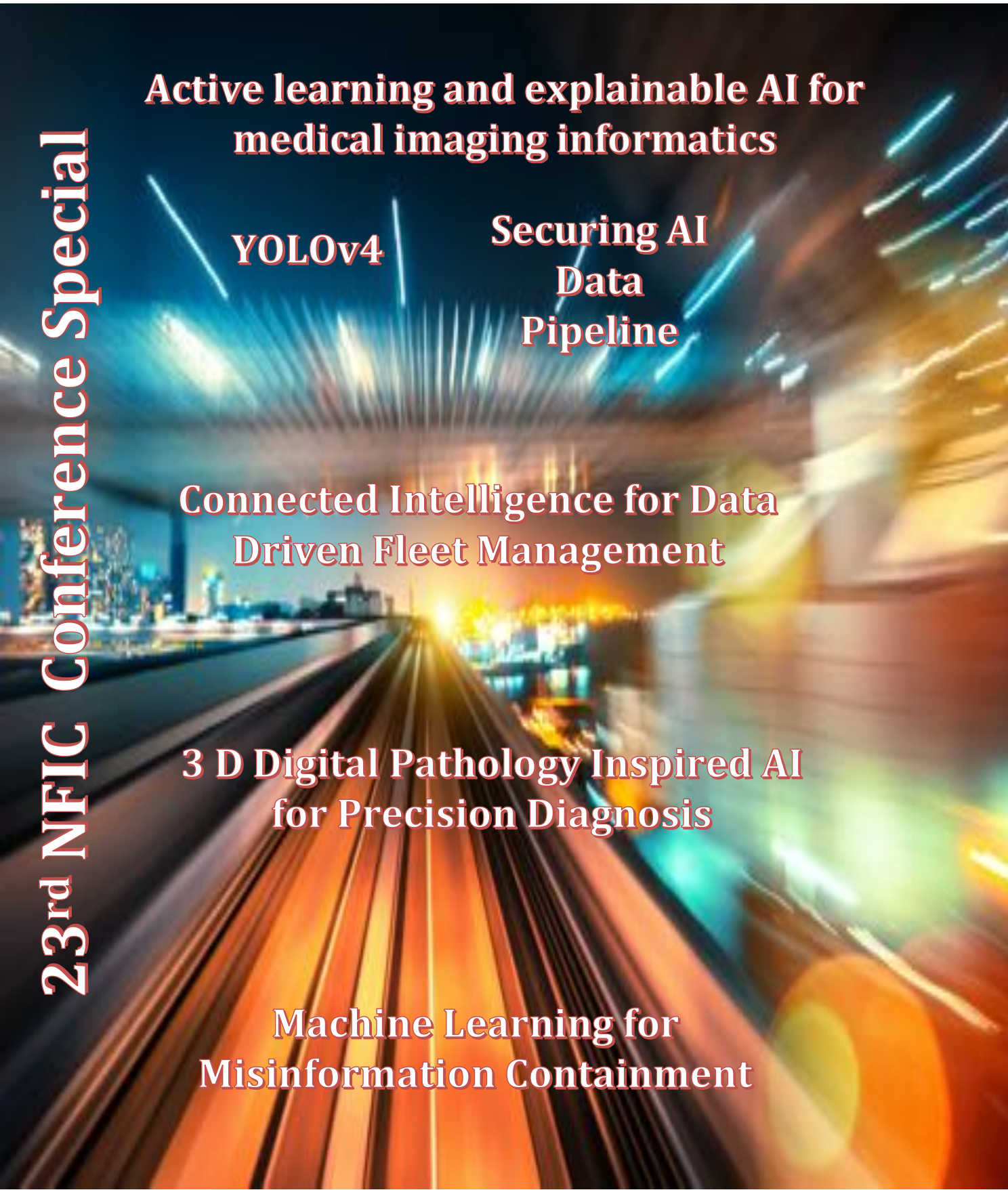

23rd NFIC Conference Special

## Active learning and explainable AI for medical imaging informatics

## YOLOv4

## Securing AI Data Pipeline

## Connected Intelligence for Data Driven Fleet Management

## 3 D Digital Pathology Inspired AI for Precision Diagnosis

## Machine Learning for Misinformation Containment

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## From the Editor's Desk

Dear Readers,

Greetings! We had yet another eventful quarter, including the 23rd NFIC in collaboration with the North America Taiwanese Engineering & Science Association, Silicon Valley Chapter (NATEA, https://natea.org/), which was well attended. Speakers from Taiwan and USA presented on emerging trends in Applied Data Science. The event received registrations from several countries as depicted in the pie chart presented inside. A list of past conference themes and venues that hosted NFIC in the past 22 years is also included inside.

Articles for future issues are welcome on all topics related to the IEEE Computer Society charter and if possible, relate to the Silicon Valley. One of the aims of this magazine is to encourage hobbyists who may not have time for full-fledged research but are still interested in publishing on leading technical topics. Please submit your articles on our website here: https://r6.ieee.org/scv- cs/?p=2036.

The September talks, including the award ceremony were in-person. The talks were collocated with IEEE GHTC conference at Santa Clara University. Please subscribe to the chapter mailing list and follow the chapter social media pages and groups to get timely updates and take advantage of the events. Most of the past events of our chapter are available on IEEE.tv https://ieeetv.ieee.org/search?search_q=scv-cs and on YouTube, where they are live broadcasted:
https://www.youtube.com/playlist?list=PLLsxQYv4DdJlYcGPwqUJsnHmfqMtB3eSJ

We are looking for more volunteers to help in various roles. You can help as a reviewer of the articles, papers, be a guest editor for special issues, help organize conferences and events, help with the publicity for our events, and more. Please consider being part of the success story by signing up here: https://r6.ieee.org/scv- cs/?p=2039. With the onset of the winter season, let's continue to Feedforward the chapter to a bright new future. Hope you are all with me in my efforts. Happy reading and happiness always!

With every best wish,
*Vishnu S. Pendyala*

Sunday, September 25, 2022
San Jose, California, USA

# Connected Intelligence for Data Driven Fleet Management (DDFM)

**Prakash Ramchandran**
eOTF

***Abstract*— Driving fleets on the ground, air or space, all need to collect appropriate volume of data, ingest, and process in streams to deliver pipelines to process continuously to manage the fleets of vehicles. Thus fleet management has become a key use case in various applications in peace or war. Defense requires platooning vehicle to vehicle (V2V) and all roads lead to data-driven modeling and analysis to schedule, safeguard and prevent accidents be it autonomous or assisted driving to support intelligent transportation or missions to planets. highlight the need for innovation with data engineering and data science to deliver the new pipelines for fleet management. We cover here the background to autonomous driving and propose Edge Computing extension to air & space for Data Driven Fleet Management.**

***Keywords*— *Vehicle to Vehicle, Connected cars, light detection and ranging, Edge Computing, Drones***

## Introduction

The Next Generation of Network (NGN) is beyond fifth generation (5G) into realm of sixth generation (6G) where the traditional Terrestrial network (TN) that include Fixed and mobile Cellular & Wireless Fidelity (WiFi) networks are being viewed as core and are being supplemented by non-Terrestrial Network (NTN) including ground (includes marine) and air and space networks. The ground Terrestrial communications are dominated by IEEE 802.nn variations and Cellular for outdoor communications. There are other Near Field Communications (NFC) like BlueTooth, Zigbi and LoRa Wide Area Network (WAN), mainly applied for Internet of Things (IOT) and we generally use them for specialized use cases using mobile phones and or for sensor & control automation.

Connection is key before one can collect data and derive intelligence through big data processing and closed loop systems to enhance the accuracy and predictions to apply as part of Data Modeling (DM) and Artificial Intelligence (AI). In this article I would like to point to research that may trigger a new trend in fleet management. The concept of Intelligent Transportation System (ITS) has been widely studied and has evolved over decades and that led to efforts in autonomous driving. Autonomous driving is a use case of Edge Computing and will refer you to IEEE International Next Generation Road (INGR) Map Edge Service Working Group as part of Future Networks [2].

### AUTONOMOUS DRIVING

Connected cars are digitized vehicles with built-in wireless networking that help besides entertainment & infotainment the ability to leverage knowledge of location, Road map and Object recognition systems using light detection and ranging (LIDAR) & radio detection and ranging (RADAR) to navigate the Car or Vehicles. Specialized vehicles by players starting Google to several Automotive manufacturers have invested their significant capital and operational resources to reach a certain level of automation.

The levels of autonomy [3] have evolved over the last decade to reach between level four & five. Note level one is minor driver assistance technology like cruise control, stop-and-go, low speed driving in traffic, simplifying parallel parking etc. Level two helps human drivers to handle some steering and breaking

controlled by electronics added to car functions through partial automation. Level three addresses complex automation via embedded on-board sensors to understand environment e.g. lane keeping at high-speed, recognizing blind spot alerting or changing lanes etc.

We are in the era of level 4 where complete self driving has been made possible by Billions of Kilometers (miles) covered by Self Driving cars with data collection and real time corrections. Having a Satellite image and corrected regularly by Self driving mappings the certain routes are well marked for licensed Self driving cars, with a caveat that legal licensing is required based on different state laws in the USA and other parts of the world. Level Five is full automation and No human interaction or intervention is required. This has although been achieved by several Auto Manufacturers and depending on laws and co-operation of the public this is enabling fleet management in certain specific use cases and most of these are considered as Pilot and moving towards general availability in near future or have achieved different milestones to deploy.

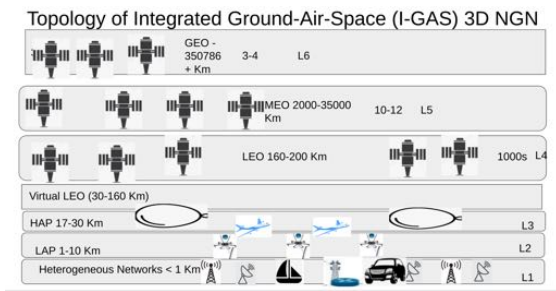


Figure 1. Topology of Integrated GAS 3D Next Generation Network [1]

DATA DRIVEN FLEET MANAGEMENT

Connected cars and Autonomous Driving on land can be applied to fleets of Drones or Air Taxis. The Intelligent Transportation Systems differ in terms of I-GAS 3D connectivity via same layer peer-to-peer as well vertically hierarchical.

Terrestrial at Ground propagation delay is ultra low and progressively increases as we move to L2 or LAP (5-10 km) <34 us and L3 or HAP Airships, Balloons etc. of the order of 56-100 us. The throughput also comes down at HAP to about 1.25 Gb/s. Typically these are programmable for specific missions like emergency support using Balloons in a flood or relief efforts due to severe weather conditions.

The Aerial transport or Air Taxis fit into a 10-17 km gap between LAP & HAP. This can then be divided into typical lanes like we have for highways and freeways and some of them are being proposed by various countries to work in their sky's as part of UAV & Air Taxis for commercial purposes. There are rules of lanes and UAV and Air taxi pilots need special training and can be done autonomously too based on remote piloting.

Data Collection as we do on buses, rails, boats will be applicable to UAV and Air Taxis. The data and its interpretation will be guided by aerial environments and traffic conditions. Commercial Air traffic has grown by a factor of 2.3 since 2000 and is likely to double in 20 years. The UAV (Drones) are being used more widely and almost quadrupling in the same time frame. Besides 1000s of LEO satellites are being launched for commercial use in all parts of the globe. The challenge is increasing probability of interference and at the same time this may be overcome by traditional radio techniques of filtering or Free Space Optical (FSO) which leads to better QoS in terms of latency throughput etc. 3GPP has been standardizing Network Data Analytics Function (NWDAF) [4] for 5G core elements and similarly O-RAN alliance has Radio Interface Controller (RIC) Analytics over its O1 & E2 interfaces [5] for real time data points and as always Operation Analytics & Management (OA&M) of Faults, Configuration, Accounting Performance & Security (FCAPS) has been managed by Telecom network operators and Cloud service providers for their platforms. Thus the cycle of data collection at source, data analytics & predictions processing using AI models and application of the same to steer better paths for vehicles in the transport fleet is being pursued by many auto and aero manufacturers.

The mixing of domain specific tools of telco to apply to transportation is in-evitable. As Base Stations in mmWave and Optical spectrum find their place in Air and Space vehicles in UAV, Airships and Satellites, the location based applications will get the same kind of reception as in autonomous driving on the ground with Terrestrial Networks.

CONCLUSION

Drawing the analogy between Terrestrial Hybrid Network Cloud and Edge Computing for Autonomous Driving, it is logical to predict future directions in the International Next Generation Roadmap (INGR) to extend the Edge to part of Sky in Air and Space. To this effect INGR is calling for CFP in its Future Networks Edge Service Workshop in November 2022 for proposals to present from Edge Service and

Architecture, Industry applications and Research point of view.

ACKNOWLEDGMENT

I acknowledge my colleagues at Future Networks INGR Dr. Ashutosh Dutta, and Mr Tapan K Lala for their encouragement to experiment as part of the working Edge Service roadmap and Chinatn Oza of TMA, Mumbai, India..

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2. INGR Roadmap for Edge Working Services - https://futurenetworks.ieee.org/
3. Transforming Industry Through Data Analytics - Cisco / O'Reilly - by Raghuram Nambiar
4. Network Data Analytics Function - ETSI TS 129 520 V15.3.0
5. O-RAN Architecture - https://docs.o-ran-sc.org/en/latest/architecture/architecture.html

The author is currently affiliated with eOTF, Mumbai, India. Author is leading the Emerging Open Tech Foundation (eOTF) as Co-Founder and Secretary since 2020. The objectives of eOTF are helping the Indian subcontinent in its Digital and Operational Transformation. He is the co-chair of INGR Edge Service working group focused on Next Generation Networking beyond 5G since 2019 from Silicon Valley. He has been a part of IEEE CS SCV chapter and a constant promoter of eOTF & INGR partnership for several years. With 40+ years of ICT industry experience in the US, EU, India and Asia-Pacific, he has led several startups and managed technically and innovated as ISP, ASP, CSP companies for decades. His insight into Vehicular Transportation Systems (VTS), Data Analytics and AI is equally formidable and has several presentations in Open Source forums globally. He holds a Master's degree in EE from IIT Bombay.Contact him/her at secretary@eotf.info.

Event Recording of the August 2nd Webinar
A New Approach for Storage-Centric Computers
*Peter Schade*
https://ieeetv.ieee.org/video/a-new-approach-for-storage-centric-computers

# NFIC Past Themes and Venues

| Year | Theme | Venue |
|---|---|---|
| **2022** | Emerging Trends in Applied Data Science | Virtual |
| **2021** | Emerging Technologies of Artificial Intelligence and Beyond | Virtual |
| **2020** | Postponed due to COVID-19 | |
| **2019** | Network of the Future Emerging Technologies for 5G and Beyond | Stanford University |
| **2018** | Accelerating Smart and Connected Communities | Santa Clara University |
| **2017** | FinTech Hedging the Financial Storm | Stanford University |
| **2016** | Cognitive Computing to the Singularity and Beyond | Stanford University |
| **2015** | Smart Grid Ecosystem- The Public and The Personal | Stanford University |
| **2014** | The Future of Online Education | Stanford University |
| **2013** | Social Network Analysis - It's Who You Know | Stanford University |
| **2012** | Emerging Medical Computing Health Care Up Close & Personalized | Stanford University |
| **2011** | Emerging Automotive Computing - Engineering in Overdrive | Stanford University |
| **2010** | Cloud Computing and the Web | San Jose State University |
| **2009** | Handheld Devices | Stanford University |
| **2008** | Cloud Computing - The New Faces of Computing | Stanford University |
| **2007** | Multi-Core Processors | Stanford University |
| **2006** | The World with RFID | Biltmore Hotel, Santa Clara |
| **2005** | Sensor Networks - The New Environment | Stanford University |
| **2004** | Semiconductors to Nanotechnology - The Coming Convergence | Stanford University |
| **2003** | Emerging Issues in Security, Mobility and Privacy | Stanford University |
| **2002** | Bioinformatics | Stanford University |
| **2001** | Nanotechnologies | Stanford University |
| **2000** | Internet Protocol Telephony | Stanford University |
| **1999** | Systems on a Chip | Stanford University |

# Active learning and explainable AI for medical imaging informatics

**Professor KC Santosh**
University of South Dakota

***23rd NFIC Keynote Address***

***Synopsis*— When we consider AI for healthcare, infectious disease outbreak is no exception. The talk will begin with machine learning models that help in not only predicting but also detecting abnormalities due to infectious diseases such as Pneumonia, TB, and Covid-19. Prof. KC Santosh opened the talk with infectious disease prediction models and unexploited data, where we will learn that predictive analytical tools are close to garbage-in garbage-out (at least for Covid19). He then covered multimodal learning and representation based on both shallow learning (handcrafted features) as well as deep learning (deep features) that typically apply on medical imaging tools. Like in computer vision, Prof. KC opened an obvious question, how big data is big in addition to common techniques: data augmentation and transfer learning. With all these facts, as most of models are limited to education and training, he ended the talk with the statement "ML innovation should not be limited to building models." What we need is #ExplainablableAI in #ActiveLearning framework.**

***Keywords— multimodal learning, infectious disease, data augmentation, transfer learning***

■ **Speaker** Professor KC Santosh is the Chair of the Department of Computer Science (CS) at the University of South Dakota (USD). Prior to that, he worked as a research fellow at the U.S. National Library of Medicine (NLM), National Institutes of Health (NIH). He worked as a postdoctoral research scientist at the LORIA research center, Université de Lorraine in direct collaboration with industrial partner ITESOFT, France. He also served as a research scientist at the INRIA Nancy Grand Est research center (France), where he received his PhD in Computer Science – Artificial Intelligence. His research projects, primarily in Applied AI, are funded (of more than $2m) by multiple agencies, such as SDCRGP, Department of Education, National Science Foundation, and Asian Office of Aerospace Research and Development. He has demonstrated expertise (with 10 books, 220+ research articles, and 20+ journal edited issues, as of Dec. 2021) in artificial intelligence, machine learning, pattern recognition, computer vision, image processing, and data mining with applications such as medical imaging informatics, document imaging, biometrics, forensics, and speech analysis. He completed leadership and training programs for Deans/Chairs (organized by the Councils of Colleges of Arts & Sciences (U.S. 21)) and PELI – President's Executive Leadership Institute (USD 21). He is highly motivated/interested in academic leadership. To name a few, Prof. Santosh is the proud recipient of the Cutler Award for Teaching and Research Excellence (USD 2021), the President's Research Excellence Award (USD 2019) and the Ignite Award from the U.S. Department of Health & Human Services (HHS 2014).

# Machine Learning for Misinformation Containment: *A Candid Assessment of the State of the Art*

**Dr. Vishnu S. Pendyala**
San Jose State University

***23rd NFIC Invited Talk***

***Synopsis*— Misinformation containment has been proven to be NP-hard more than a decade ago. It is undoubtedly a complex problem to solve and appropriately attracted plenty of attention from the research community. A wide variety of machine learning algorithms such as support vector machines and logistic regression, ensemble techniques like random forest and Adaboost, deep learning frameworks such as LSTM and GAN, language models like BOW / TF-IDF and BERT, and many more have been tried out in the attempts to solve the problem. In terms of feature engineering as well, no stone has been left unturned. Manual feature extraction, graph embeddings, and other approaches to representational learning have all been tried. Not just supervised and unsupervised learning, but various other types of learning such as few-shot learning, meta learning, transfer learning, self-supervised learning, semi-supervised learning, reinforcement learning, and active learning have been explored extensively for the problem. Despite the voluminous research literature purporting to solve the problem using machine learning methods, misinformation containment is largely unsolved and is in fact growing by the day. It is therefore pertinent to understand this huge disconnect between what is claimed in the literature and the actual reality. The talk provided insights into the current state-of-the-art solutions and analyzed why they are not helping enough. The talk presented some future directions that in the speaker's opinion hold the promise and explained why there is hope.**

***Keywords*— *Deep Learning, Natural Language Processing, Self-supervised Learning***

■ **Speaker** Dr. Vishnu S. Pendyala is a faculty member of the Department of Applied Data Science at San Jose State University and the chair of IEEE Computer Society, Silicon Valley Chapter. He has over two decades of experience with software industry leaders like Cisco and Synopsys in the Silicon Valley, USA. Dr. Pendyala served on the Board of Directors, Silicon Valley Engineering Council during 2018-2019. During his recent 3-year term as an ACM Distinguished speaker and before that as a researcher and industry expert, he gave numerous (50+) invited talks. He holds MBA in Finance and PhD, MS, and BE degrees in Computer Engineering from US and Indian universities. Dr. Pendyala taught a one-week course sponsored by the Ministry of Human Resource Development (MHRD), Government of India, under the GIAN program in 2017 to Computer Science faculty from all over the country and delivered the keynote in a similar program sponsored by AICTE, Government of India in 2022. Dr. Pendyala's book, "Veracity of Big Data: Machine Learning and Other Approaches to Verifying Truthfulness" is indexed in several libraries, including those of MIT, Stanford, CMU, and internationally.

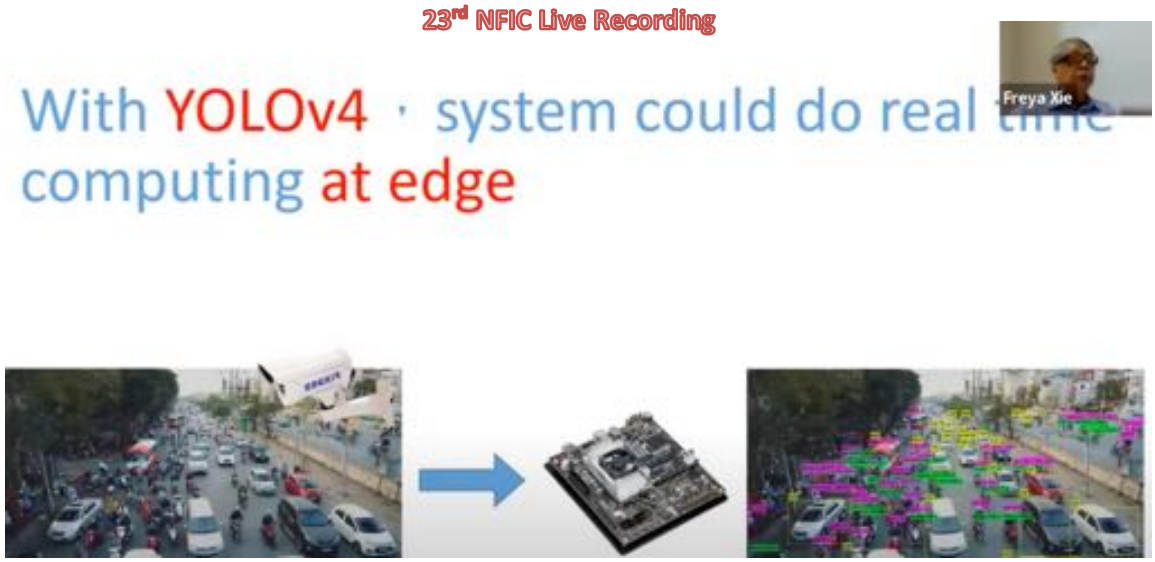
# YOLOv4 and Its Applications

**Dr. Mark Liao**
Institute of Information Science,
Academia Sinica, Taiwan

***23rd NFIC Invited Talk***

***Synopsis*— YOLOv4 has been ranked first in the world object detection competition for two and a half months. It defeated the R&D teams of international companies such as Google, Amazon, Facebook, Microsoft, and Qualcomm. The birth of YOLOv4 is actually closely related to the project "Development of Smart Transportation System". This project is funded by the Ministry of Science and Technology, and it has led to a four-year cooperative relationship between the Academia Sinica and the listed company Elan Electronics. The speech explained in detail the beginning and end of the implementation of this smart transportation project, and how to develop YOLOv4, the fastest and most accurate object detector in the world during the execution of the project.**

■ **Speaker** Dr. Mark Liao received his Ph.D. degree in electrical engineering from Northwestern University in 1990. In July 1991, he joined the Institute of Information Science, Academia Sinica, Taiwan, and currently is a Distinguished Research Fellow and Director. He has worked in the fields of multimedia information processing, computer vision, pattern recognition, multimedia protection, and artificial intelligence for more than 30 years. He was appointed an Honorary Chair Professor of National Chiao-Tung University from 2016 to 2019. He received the Young Investigators' Award from Academia Sinica in 1998; the Distinguished Research Award from the National Science Council in 2003, 2010, and 2013; the Academia Sinica Investigator Award in 2010; the TECO Award from the TECO Foundation in 2016, and the 64th Academic Award from the Ministry of Education in 2020. His professional activities include: President, Image Processing and Pattern Recognition Society of Taiwan (2006-08); Editorial Board Member, ACM Computing Surveys (2018 – present), IEEE Signal Processing Magazine (2010-13); Associate Editor, IEEE Transactions on Image Processing (2009-13), IEEE Transactions on Information Forensics and Security (2009-12) and IEEE Transactions on Multimedia (1998-2001). He has been a Fellow of the IEEE since 2013.




https://www.youtube.com/watch?v=GuS6LqqB_hc

# Trends in Securing AI Data Pipeline

**Prakash Ramchandran**
Open Tech Foundation (eOTF)

*23rd NFIC Invited Talk*

***Synopsis*— Machine Learning models apply labels to data or collect samples dynamically and curating them. Data needs be clean and relevant to building or optimizing models and delivering the analysis and inferences that lead to improving the accuracy of results with greater optimization and making than more human like intelligent yet applying MLOps, automation and efficient delivery for multiple domains and use cases. In the data pipeline from various sources they can be compromised and hence need to secure them. The speaker led the audience through the causes and biases that can be controlled through use of best practices and shared the trends in securing data pipeline in AI.**

■ **Speaker** Prakash is leading Emerging Open Tech Foundation(eOTF) as Co-Founder and Secretary since 2020. The objectives of eOTF are helping the Indian subcontinent in its Digital and Operational Transformation. He is co-chair of INGR Edge Service working group focussed on Next Generation Networking beyond 5G since 2019 from Silicon Valley. As part of NFIC from IEEE CS SCV chapter and a constant promoter of IEEE & NATEA partnership over several years. With 40+ years of ICT industry experience in the US, EU, India and Asia-Pacific has led several startups and managed technically and innovated as ISP,ASP, CSP companies for decades. His insight into Data Analytics and AI is equally formidable and has several presentations in Open Source forums globally. He holds a Masters degree in EE from IIT Bombay.

September Events Live Recording
https://www.youtube.com/watch?v=84ucEVqC890

# 3D Digital Pathology Inspired AI for Precision Diagnosis

**Dr. Tun-Wen Pai**
National Taipei University of Technology
Taipei, Taiwan

**Dr. Yen-Yin Lin**
JelloX biotech Inc

*23rd NFIC Invited Talk*

***Synopsis*— Digital medical images for training AI models have made major impact on precision diagnosis, among which digital pathology transforming glass slide stains to whole slide images (WSIs) facilitates systematic analysis of tissue morphology and biomarker distribution. Integrating thick tissue staining, 3D image scanning, software and deep learning algorithms, we have retrieved hundreds more high resolution digital images with spatial features from each clinical biopsy to develop novel AI models for precision diagnosis of morphology variation, tumor recognition, and biomarker expression. The breakthrough technologies support matching right patients to right treatment, contributing to precision medicine.**

■ **Speaker** Dr. Tun-Wen Pai earned his Ph.D. in E&CE from Duke University, Durham, NC; MS in E&CF from John Hopkins University, Baltimore, MD USA. Presently, Dr. Pai is the Chairman of Computer Science and Information Engineering, National Taipei University of Technology, Taipei, Taiwan. Dr. Pai has published numbers of papers which are available upon request.

■ **Speaker** Dr. Yen-Yin Lin earned his Ph.D., MS degrees in Electrical Engineering , and BS degree in Nuclear Science from National Tsinghua University, Hsinchu, Taiwan. Presently, Dr. Lin is the CEO of JelloX biotech Inc., Hsinchu, Taiwan. His previous work experience includes: Chief Executive Officer, MOST Industrial Value Creation Program to develop AI and image inspection system for precision anatomy research Brain research center at National Tsinghua University in Hsinch, Taiwan; Visiting Research Fellow at Stanford University in California; R&D Consultant at Micotech Instruments in Oregan; Visiting Research Assistant at Brookhaven National Laboratory in New York. Dr. Lin's publications include 47 papers in prestigious journals, more than 80+ conference papers (3 invited speeches in the first tier/+10000 participants conference, 1 worldwide webnair hosted by the Optical Society of America) and 16 issued USA or Taiwan patents. Dr. Lin received the following honors: 2022 Boehringer Ingelheim Grass Roots Award; 2021 The 20th Business Startup Award-MOEA in Taiwan; 2021 Gold Award-Entrepreneur Warrior Competition; Future Technology Award-MOST in Taiwan 2021 and Others. In 2007 Dr. Lin received the outstanding Ph.D. dissertation award from the Optical Engineering Society of the Republic of China in Taiwan. He originated several novel laser systems, such as, novel electro-optic laser Q-switch (USA Patent No. US20110075688 A1), quasi-phase-matching PDT/PDD laser sources (TW Patent No.196412), cascaded quasi-phase-matching QPM laser source (TW Patent No.I225948).

# Upcoming Webinars

## Quantifying Configuration Health of Software Systems

...DevOps, Software configuration health index, diagnosing configuration problems, ...

**Prof. Krishna Kant, IEEE Fellow, Temple University**
https://www.kkant.net/

Wednesday, November 2nd, 2022, 9:00 am PT

Register (Free): https://r6.ieee.org/scv-cs/quantifying-configuration-health-of-software-systems/

**Vishnu S. Pendyala, Chair**
**John Delaney, Vice Chair**
**Sujata Tibrewala, Secretary**
**Sachin Desai, Treasurer, and team**

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## Democratizing NLP: considerations from resources to algorithms

...NLP support for low-resource languages, NLP algorithm design...

**Dr. Maunendra Desarkar, Indian Institute of Technology (IIT) Hyderabad**
https://people.iith.ac.in/maunendra/.

Mon, December 12th, 2022, 6:30 pm PT

Register (Free): https://r6.ieee.org/scv-cs/democratizing-nlp-considerations-from-resources-to-algorithms/

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**John Delaney, Vice Chair**
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