Wireless **I**ntelligent **N**etworks

5GWIN Association

Research Projects

5G WIN Association

5GWIN is endorsed, funded and operating within the framework of Israel Innovation Authority

5G WIN is a non-profit association ,registered in Israel according to Association Law of the Ministry of Justice

5GWIN is funded in 2020 for the sole purpose of advancing the research and knowhow in specific 5G Intelligent Network topics

Main focus
1. **Conducting AI based academic research for 3 years in diverse AI topics**
2. **Evaluation and use of AI academic results for the enhancement of 5G enabling technologies developed previously by the Industrial partners**

5G WIN Association members

Academic Research Centers
(No of research projects)

1. Technion Haifa (3)
2. Bar Ilan Uni. (2)
3. Ariel Uni (1)
4. Ben Gurion Uni (BGU) (2)
5. Tel Aviv Uni (TAU) (1)
6. LEV Uni. Jerusalem (2)

Industrial members

1. Mobilicom
2. Elbit
3. RunEl
4. CEVA
5. Ceragon
6. Asocs

5G WIN Research Projects

Ariel Univ	Solutions for Low Latency Indoor- Prof Yossi Pichasi	1
BGU	Scheduler based on Machine Learning- Prof. Haim Permuter	2
Technion	Theoretical Aspects of Learning in Communicatio Prof.Shlomo Shamai	3
TAU	Novel Scheme for low latency Reliable Communication Prof. Uri Erez/Anatoly China	4
BGU	AI assisted Scheduling in Wireless Mesh Networks -Prof.Ron Debora	5
Technion	Mmm Digital Beam Forming Array CMOS supporting Full duplex-Prof Emanuel Cohen	6
LEV	Dynamic Security measures in Mesh Networks- Dr Rina Azoulay	7
LEV	Resource Allocation in Cellular MESH Networks using ML-Prof Yoram Haddad	8
Technion	Using Machine Learning for the optimization of 5G Managemnt & Data Planes R. Cohen	9
Bar Ilan	Security and rivacy in Neural Networks and other Learning Systems- Prof. Yossi Keshet	10

Main Topics and challenges to be tackled in Research programs

1. **Scheduler with Machine Learning-** Prof. Haim Permuter (B.G Uni)
Based on information like SINR and RSSI (Received Signal Strength Indicator), the scheduler decides:
- Which packet to forward next
- Which Frequency
- Which Base Station
- Transmitting power
- Modulation (QPSK, 16QAM, 64 QAM etc..

3. **Theoretical aspects of Learning in Communication-** Prof. Shlomo Shamai (Technion)
   1. The distributed bottleneck in communication models and basic analysis
      - Connection of bottle neck problems and classical information theoretic features
      - Formulation of basic theoretical connections with practical implications
   2. Ultimate performance of Wireless Cloud Radio Access for CRAN systems
      - Analytic description of capacity regions and bounds for and bounds for CRAN via incorporation of the theoretical results   for distributed bottle neck problems/

Main Topics and challenges to be tackled in Research programs

4. Novel scheme for low latency Reliable Communication- Prof. Uri Erez and Anatoly Khina
We have a greedy real-time scheme for scalar control over fixed-rate channel
 - The goal is to understand how well this scheme compared to theoretical optimum. How to design a globally optimal solution

5. AI assisted Scheduling in Wireless Mesh networks- Prof. Ron Dbora and Kobi Cohen (BG Uni.)
The challenges-In the proposed research the scheduling problem is addressed from 3 perspectives:
- Network synchronization in the physical layer
- Optimization of the parameters of the links between different network units
- Optimization of the overall scheduling, including merging and splitting processes

6. Mmw Digital Beam forming Array in CMOS supporting Full duplex- Prof. Emanuel Cohen- (Technion)
Chain Phased Array Transmitter:
- Developed chip can support Phased Array with high accuracy phase shift
- Supports massive MIMO and fully beamforming with separate IF enabling interface to SoC
- Can serve as a basic cell for WAI operation

Main Topics and challenges to be tackled in Research programs

7- Dynamic security measures in MESH Networks-Dr Rina Azoouley (LEV)
 - Dividing drones into clusters or flocks
- Defining communication network topology
- Problem solution in Routing and Scheduling once network topology is defined
- Network updates in case of changes

8. Resource allocation in Cellular MESH networks using ML-Prof. Yoram Hadad
 Drones Security Challenges:
- Firmware- Avoid Hijacking, supply chain attack & backdoors
- Communication protocol- key sharing, stealing of key from one of the drones in the swarm and the spoofing attack, timing is critical

Main Topics and challenges to be tackled in Research programs

9. **Using Machine Learning for the Optimization of 5G Management & Data Planes- Prof. Reubin Cohen and Prof. Dany Raz (Technion)**
   - Optimization methods in selection
   - Optimal use of radio resources compatible with different missions and link state
   - Network slicing
   - Management and optimization of virtual resources in distributed method

10- **Security and Privacy in Neural Networks and other Learning systems- Prof. Yossi Keshet (Bar-Ilan Uni.)**
   - Understanding the vulnerabilities of different Machine learning algorithms
   - Designing robust and secured Deep Learning algorithms
   - Detecting adversarial example attack

Thanks