Machine learning and big data analytics (for spatial and temporal demand shaping) in wireless communications (5G and beyond)

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The idea:
For heterogenous networks (HetNets): utilize and take advantage of the
  1. Machine/deep learning and
  2. Big data analytic tools
that have been developed during the last decade and use them to add
  • more cognitive/learning ability in the system,
  • well informed user centric decisions/optimizations,
  • self evolution/adaptation capability,
and apply them to HetNets for 5G and beyond wireless systems.

If you are an algorithm/SW/system developer for wireless communications, and would like to get ahead by adding value to the existing solutions by using deep learning algorithms/AI/data analytics tools, this project may be a good opportunity.
HAVELSAN, Turkey

Personnel: ~1380
85% Electrical & Computer Engineers
~40M Euros of R&D Budget

TURKISH ARMED FORCES FOUNDATION

LEADING INFORMATION TECHNOLOGY,
INTELLIGENT SYSTEMS TECHNOLOGY
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IN DEFENSE, SECURITY & CIVILIAN
TECHNOLOGY MARKETS

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Proposal Introduction (1)

Machine learning and big data analytics for wireless communications (Het-Nets/5G+)

In order to reduce the O/CAPEX of MNO’s, **Machine Learning/AI/Data analytic techniques** can substantially diminish human involvement in HetNets towards reaching the advanced concepts of **SONs**, regarding operational tasks, and optimizing network capacity and coverage, and QoS.

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Proposal Introduction (2)

- Different scenarios for establishing these learning algorithms for a SON as an SDN concept can be implemented.
- 30-36 months of Schedule with 6-10 partners (possibly with university/research lab collaborators as subcontractors/consultants)

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Models/algorithms</th>
<th>Example wireless applications</th>
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<tbody>
<tr>
<td>Statistical modeling</td>
<td>Markov models, time series, geometric models, Kalman filters</td>
<td>Mobility prediction, resource provision, device association/handoff prediction</td>
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<td>Data mining</td>
<td>Pattern matching, text compression, clustering, dimension reduction</td>
<td>Mobility prediction, social group clustering, context-aware processing, cache management, user profile management</td>
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<td>Machine learning</td>
<td>Classification algorithms, neural network, regression analysis</td>
<td>Context identification, traffic prediction, fitting trajectory length, user location and the channel holding time</td>
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<td>Dimension reduction algorithms: PCA, PARAFAC, Tucker3</td>
<td>User data compression/storage, traffic feature extraction, blind multiuser detection</td>
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<td>Q-learning</td>
<td>Handoff and admission controls</td>
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<td>Primal/dual decomposition, ADMM</td>
<td>Distributed routing/rate control and wireless resource allocation</td>
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<td>Online convex optimization, stochastic learning</td>
<td>Online mobility predictions, handoffs, and resource provisioning</td>
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<td>Active learning, deep learning</td>
<td>Incomplete/complex mobile data processing</td>
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Partners

• Currently we are working with Carleton University, Ottawa, Canada.

• We need at least 5-6 algorithm and software development partners; At least 1 mobile network operator, possibly 2.

• Here is another Project Proposal Topic to be investigated:

  • Drone/UAV/aerial Base Stations and low-altitude/medium-altitude/high-altitude platforms (LAPs/MAPs/HAPs) for Wireless Base Stations to maximize coverage for users with different QoS requirements.
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