Engineering Network and Interference Geometry for the Analysis and Design of Next Generation Wireless Networks

Results in Brief

In-depth look into wireless networking to improve the future of mobile

A new generation of mobile network technology is beginning to take shape, with far-reaching implications to daily life and work. An EU initiative looked into the challenges posed by such wireless networks.

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From mobile devices to e-health, fifth generation (5G) wireless networks will positively impact a wide range of applications. However, such a broad scope of application areas presents new interoperability challenges for heterogeneous network architectures. It also requires novel approaches for tackling interference to support data rates peaking at 1 Gbits/sec and 100 Mbits/sec in low and high mobility environments, respectively. The EU-funded ENIGMA (Engineering network and interference geometry for the analysis and design of next generation wireless networks) project set out to tackle such issues.

Overall, project partners engineered network and interference geometry to obtain

fundamental performance bounds and metrics. They proposed novel optimal or near-optimal control algorithms to reduce interference for 5G or beyond 5G heterogeneous wireless and complex networks.

Researchers developed a stochastic geometry-based foundation for wireless networks. They achieved this by synthesising more realistic network and wireless physical layer models with geometric network analysis to determine collective network behaviour.

The ENIGMA team calculated important performance bounds and metrics such as successive interference cancellation probability, outage probability, area spectral efficiency and transport capacity of wireless networks. It also presented techniques, algorithms and protocols to deal with the negative impact of interference and maximise bit rates that are subject to limitations, including peak power, fairness and feedback constraints.

ENIGMA contributed to uncovering hidden underlying dynamics and operating principles for next generation wireless heterogeneous and complex networks. These key contributions involve three main areas: geometric design and analysis of next generation wireless heterogeneous networks; protocol and algorithm design for next generation wireless heterogeneous networks; and analysis of distributed processes running on complex networks.

In total, 26 scholarly publications helped to improve understanding of wireless networking.

ENIGMA laid the foundation for analysing and designing next generation wireless heterogeneous and complex communication networks. This has important implications for society, industry and service sectors that are increasingly looking to wireless mobile technologies for energy efficiency, environmental protection and health monitoring.

Keywords

ENIGMA | interference geometry | next generation wireless networks | complex networks | heterogeneous networks

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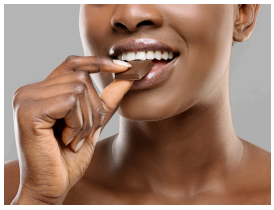

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