

PhD Opportunity at EURECOM and Inria funded by Laboratoire d'excellence UCN@SOPHIA

Topic	<u>Ultra-dense cloud-based wireless networks: Design and Analysis</u>
Institutions	Eurecom and Inria, Sophia Antipolis, France
Advisors	Laura Cottatellucci and Konstantin Avrachenkov
URLs	http://www.eurecom.fr/en/people/cottatellucci-laura http://www-sop.inria.fr/members/Konstantin.Avratchenkov/me.html
Start date	As soon as possible
Duration	Three years
Description	<p>Next 5G wireless systems shall satisfy the increasing demand of higher and higher data rates at very competitive prices as well as be able to efficiently accommodate for and adapt to a huge dynamic range of services, applications, and types of devices expected in the near future (e.g. see smart cities technologies, Internet of Things). Appealing architectural solutions leverage on ultra-densification of antennas and heterogeneity. Ultra-dense networks (UDN) in 5G wireless systems envision ultra-dense distributed antenna systems based on remote distributed antennas empowered by the e-cloud for a centralized processing. Heterogeneity is necessary to efficiently cover the huge dynamic range of applications and services. Heterogeneous-UDN (H-UDN) concerns the co-existence of emerging and legacy technologies such as operator-driven UDNs and massive-MIMO enriched macro-cells, user-deployed or “crowd-sourced” access nodes, such as Wi-Fi access points, femto-cells, or even smart-phones acting as local access prosumers.</p> <p>The proposed doctoral program will explore the fundamental limits and potentials of both UDN and well defined scenarios of H-UDNs and will develop efficient resource allocation algorithms attaining almost-optimal performance under constraints of scalability, flexibility to adapt to user geographic distributions, and robustness. Based on large system analysis, the PhD candidate will develop an insightful understanding on the impact of global network</p>

parameters (e.g. number of users and access points per unit area, number of active antennas per access point, channel fading properties) on the network performance. Processing techniques for complex networks, i.e. networks with a massive number for nodes, will be applied in the development of resource allocation techniques. The final goal is to provide practical criteria for the design of 5G networks and to construct algorithms for efficient network operation.

Some References

- L. Cottatellucci, "Capacity per Unit Area of Distributed Antenna Systems with Centralized Processing", IEEE Global Communications Conference (GLOBECOM), Austin, U.S., Dec. 2014.
- L. Cottatellucci, et al. "Asynchronous CDMA systems with random spreading—Part I: Fundamental limits". IEEE Trans. on Information Theory, vol. 56, no. 4, Apr 2010.
- E. Altman, K. Avrachenkov and J. Goseling, "Distributed storage in the plane." In IFIP Networking Conference, 2014.
- B. Kauffmann, F. Baccelli, A. Chaintreau, V. Mhatre, K. Papagiannaki and C. Diot, "Measurement-based self organization of interfering 802.11 wireless access networks." In IEEE INFOCOM 2007, pp. 1451-1459.

Requirements

We are looking for a highly motivated person with a master degree in engineering, mathematics, computer science, communications and information technology or related fields. The key prerequisite is excellent mathematical skill. Specialization in advanced probability theory and/or linear algebra will be considered an advantage. Relevant prerequisites are also a certain degree of independence, capability to take initiative, and good English command.

Application File

Motivation letter, CV, academic transcripts (with explanation of the grade scale adopted), 2 references (letters or names)

Email addresses for application and questions

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Eurecom and Inria are located in Sophia Antipolis, a vibrant science park on the French Riviera. It is in close proximity with a large number of research units of leading multi-national corporations in the telecommunications, semiconductor and biotechnology sectors, as well as other outstanding research and teaching institutions. A freethinking, multinational population and the unique geographic location provide a quality of life without equal.