Machine Learning and Information Processing for Communications

(This flyer will be updated soon)

Offered by:	Department of Electrical Engineering
Language:	English
Primarily interesting for:	EE
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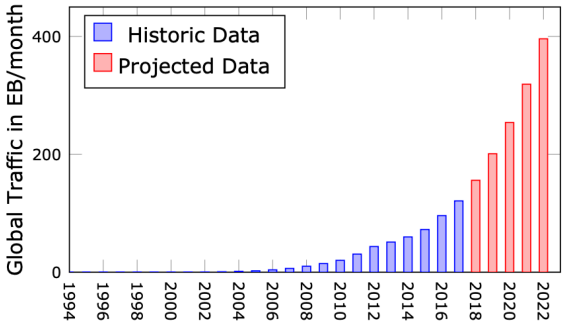
Content and composition

Our society is shaped by the digital revolution, which can be traced back to 1948's pioneering work by C. E. Shannon, nowadays known as the father of the information era. The Internet traffic currently flows through cables, optical fibers, satellite and wireless links at previously unimaginable speeds. This always-connected society we live in is therefore generating vast amounts of data which needs to be properly processed. Information need to be safely stored but also transmitted from source to destination, often through complex communication networks. The generated data can also be used by artificial intelligence to learn and monitor telecommunication systems and also to improve digital signal processing (DSP) algorithms used therein.



Historic global data traffic based on Cisco Visual Networking Index.

The aforementioned topics are covered in the coherent package *Learning and Information Processing for Communications*, where problems related to digital information are treated from telecommunications, information theory, and machine learning perspectives. Application examples of this coherent track include high-speed multi-hop fiber optical networks, wireless communications, information-theoretic security (e.g., fingerprints for chips), car-to-car communications and media access control for autonomous driving, and deep neural networks for DSP algorithms and network monitoring.

Information and communication technologies
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The coherent package *Learning and Information Processing for Communications* includes three elective courses, as shown in the table below. Previous courses of particular importance

for this package are Intro Telecommunications (5ETA0) and Communication Theory (5ETB0). The package is structured such that students focus first on fundamentals on machine learning and information theory, and then move into a more applied course on telecommunication systems.

Course Code	Code Name	Schedule
5XSL0	Fundamentals of Machine Learning	Q4 (timeslot D), year 2
5XSE0	Information Theory	Q3 (timeslot A), year 3
5XTA0	Telecommunication systems	Q4 (timeslot B), year 3

Course Descriptions

Fundamentals of Machine Learning (5XSL0)

This course offers a solid theoretical basis for modern machine learning methods. It focuses on the mathematical foundations of machine learning, presenting diverse elementary techniques together with a detailed examination of the methods for evaluation of model performance. This theoretical approach is complemented with hands-on assignments to gain experience and go deeper into the scope of machine learning techniques.

Information Theory (5XSE0)

In this course, the mathematical theory underlying digital information is treated. Key concepts like mutual information, entropy, channel capacity, etc. are studied in detail. The most important results related to source coding (data compaction) and channel coding (error-correction) are presented. The theoretical approach is complemented with exercises, real-world examples of applications of information theory, and hands-on Matlab assignments.

Telecommunication systems (5XTA0)

This course gives a general overview of telecommunication systems. The course explains the techniques wireless and wired use to send information from multiple users over multihop networks. The course will analyze digital modulation formats, multiple access techniques, network architectures, Internet Protocol addressing and routing. Laboratory and instructions sessions boost the understanding of a selection of those topics with practical assignments.