<Professor Si-Hyeon Lee's Lab>

InfoLab Information and Communication Research Lab

■ **Contact information**

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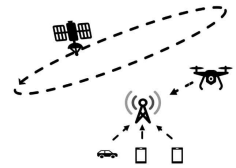
■ **Current state of the Lab. (in 2025 Spring Semester)**

PhD Students: 10, MS Students: 5, Postdoc: 1

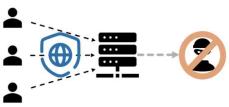
■ **Research Areas**

Our lab is working both on the study of fundamental theories and on the development of practical schemes and algorithms for communication and machine learning. For the theoretical part, we are interested in the characterization of information-theoretic capacities and fundamental trade-offs for various communication and learning problems. For the practical part, we are interested in designing practical schemes for next-generation communications, improving the state-of-art machine learning algorithms.

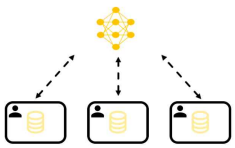
The followings are some topics on which our lab has been working on.



Wireless communications: Our research lab specializes in advancing wireless communication technologies, with focus on achieving broader coverage, higher transmission rates, lower latency, and supporting AI-driven services. Our key areas of research include efficient multi-layer communication across terrestrial, aerial, and space layers, optimization of reconfigurable intelligent surfaces (RIS), and edge computing technologies aimed at enabling efficient AI computation.



Differential privacy: Our data travels through various paths, like when you do computer searches or play games. During this process, unintended privacy leaks can become a serious problem. A technology that effectively protects against these privacy threats is differential privacy. We're studying differential privacy techniques in a variety of applications such as big data analysis and machine learning.



Federated learning: Federated learning is a decentralized machine learning paradigm where multiple clients collaboratively train a shared model without exchanging their raw data. Instead, each client computes model updates locally and only shares the updates with a central server, preserving data privacy. Our research lab is working on the development of robust federated learning models against various challenging learning scenarios.

Quantum information theory: The intriguing properties of quantum phenomena such as superposition and entanglement are expected to drive revolutionary advancements in computing and communication. We explore fundamental gains by harnessing quantum resources for communication and data processing.

■ **Career:** Communications and machine learning are highly demanded research areas in industry and academia.

■ **Introduction to the lab:** Our lab fosters a horizontal and creative environment that encourages students to fully develop and demonstrate their abilities. We welcome self-motivated and creative students, passionate about fundamental theories and developments of communication systems and machine learning algorithms.

■ **Recent research achievements**

Our lab published 35 SCI journal papers CS top conference papers, including several papers in IEEE TIFS (impact factor top 5%), IEEE TIT (#1 in information theory), and NeurIPS and ICML (top CS conferences).