Cyberinfrastructure for AI empowered society

Research supervisor: Shinji Shimojo (Professor, Faculty of Software and Information Technology, Aomori University)

Overview

As the world moves towards a "AI symbiotic society ", the amount of data flowing on networks will grow rapidly in the future. Therefore, to make AI more widely available in society in the future, we need to tackle various challenges to create the next-generation cyber infrastructure (CI) that will support this data distribution, and have innovative ideas to overcome the constraints of conventional thinking and principles due to various technical limitations in communication and computation and changes in service architectures. It is crucial to cultivate young researchers who can create new domains of technology and society with original ideas that surpass the various technical limitations in communication and computation, as well as the constraints of conventional thinking and principles due to changes in service architectures.

This research area supports ambitious research that will contribute to the development of the next generation of CIs, based on original ideas from young researchers with the theme of "technologies that will create future breakthroughs in information and communication science," regardless of the current application prospects. Specifically, we will foster research in various fields, such as information, communications, system architecture, security, AI, quantum computing and communication, devices, software, mathematics, engineering, and social sciences, and encourage research that is grounded on one's own expertise but also covers the wide hierarchy of information

and communication. We also welcome creative ideas that are not confined to the traditional categories of information and telecommunication.

In promoting research, we place emphasis on fostering young researchers and providing opportunities for interactions among researchers in different fields. We also aim to build a network of human resources that will lead to future collaboration.

This research area participates in the Ministry of Education, Culture, Sports, Science and Technology (MEXT)'s Advanced Integrated Intelligence Platform Project on Artificial Intelligence/Big Data/IoT/Cybersecurity (AIP Project).

Research Supervisor's Policy on Call for Application, Selection, and Management of the Research Area

1. Context

As AI services, including generative AI, become increasingly pervasive and accessible to a broader population, the vision of a globally realized "society in symbiosis with AI" emerges on the horizon. Within this framework, the proliferation of data across networks is anticipated to undergo exponential growth. Consequently, critical issues such as energy efficiency, reliability, and real-time performance are poised to garner heightened attention in the times ahead.

However, the significance of cyber infrastructure (CI), the backbone supporting an "AI symbiotic society," has often been overlooked. Recognized as a complex system of computers, networks, and software, CI is set to ascend as a crucial social infrastructure. Moreover, given the evolutionary trajectory of information sharing systems epitomized by the Internet—forged through the acceptance of inherent risks— the development of systems necessitates not only conventional information and communication technologies but also an understanding of societal risk acceptance, encapsulated as social technologies.

Within this research area, our objective is to illuminate the overlooked facets of CI, forge the next generation of CI, and catalyze the creation of foundational science and technology requisite for the impending "AI symbiotic society." Central to this endeavor is the cultivation of exceptional young researchers possessing originality and the potential to spearhead future advancements.

This research ambit champions audacious inquiry that promises to engender novel value, guided by the overarching theme of "technology catalyzing future innovations in communication and information science," without tethering it to immediate applicative ends. Embracing a diverse spectrum of disciplines—from information and communications to system architecture, security, AI, quantum computing and communication, devices, software, mathematics, engineering, and social sciences—the program seeks to nurture talent and foster collaborative networks.

Eligible candidates for this research domain encompass young researchers with less than eight years of experience post-PhD, or less than 13 years post-Bachelor's degree (including graduate students) if they haven't yet obtained a doctoral degree, excluding periods of maternity or childcare leave in either scenario.

2. Principle of invitation project and selection

This research initiative solicits proposals focusing on "research driving future innovations in information and information science" across a breadth of domains, spanning information, communications, system architecture, security, AI, quantum computing and communications, devices, software, mathematics, engineering, and social sciences. We are in pursuit of young researchers poised to tackle the challenges of emerging fields that transcend disciplinary boundaries, be it from CI to applications, applications to CI, CI to social technology, and beyond. Particularly, we encourage proposals that encompass a diverse array of communication hierarchies, welcoming novel concepts that transcend traditional telecommunications categories.

While individual technologies play a pivotal role in CI innovation, it's equally imperative to amalgamate them and contemplate them within the context of overarching system architecture. Within this research domain, however, the focus extends beyond architecture alone. We seek individuals capable of envisioning robust and adaptable system architectures with a keen societal perspective, individuals who can drive architectural evolution, and those adept at crafting resilient architectures.

At the proposal stage, expertise and research accomplishments across multiple domains and hierarchies are not prerequisites. However, we anticipate ambitious proposals that advance beyond the confines of individual research subjects. Proposals should delineate the issues they aim to address within the broader system and articulate how they intend to catalyze future innovations in telecommunications and information science.

3. Research periods and research funds

The research period will be two years and six months. The standard research expenses are 4.5 to 6 million yen (excluding indirect expenses) in total (research expenses do not need to be divided equally among each year). The selected applicants will undergo a progress evaluation approximately two years after the start of the research, at which time additional support (several million yen) will be provided for one year as an acceleration phase for research proposals that are expected to lead to even greater results through continued research support. The number of adopted proposals is expected to be 20 to 30, but this number may change depending on the budget situation and the research budget of the adopted proposal.

If a graduate student is selected, he/she may apply for his/her own RA expenses in addition to the above-mentioned research expenses.

4. Area Management Policy

The objective of this domain is to foster vibrant exchanges among diverse fields associated with CI and establish a cohesive community within the CI domain. Given the rapid technological advancements in this sphere, it's imperative to cultivate a human network that transcends the dichotomy between basic and applied research, enabling the execution of innovative and dynamic R&D endeavors. We will cultivate researchers with expansive outlooks by actively facilitating interactions with a broad spectrum of individuals both within and outside the field.

Moreover, each researcher in this domain will be paired with an area advisor, a prominent figure in their respective field, fostering an environment conducive to discussing research at the request of the selected researcher. Additionally, area meetings will be convened, bringing together research supervisors, area advisors, and selected researchers to foster inter-researcher exchanges. We anticipate that networking among diverse young researchers will catalyze the development of cross-disciplinary group research. Domestically, collaborations with institutions such as ITRC, IEICE, IPSJ, JANOG, among others, will provide avenues for mutual exchange, while internationally, engagement with relevant communities like APAN, IETF, IRTF, etc., will bolster Japan's presence in the CI domain.

While presentations at top international conferences and journals hold significance in the CI field, we also underscore the importance of outputs through avenues such as open-source software, standardization efforts, and demonstration experiments in real-world settings. This research domain

actively encourages such initiatives. Therefore, leveraging real networks like SINET and JGN, alongside collaborations with external projects, is strongly encouraged.

Our management approach aims to provide researchers with the freedom and openness to concentrate on their research while fostering the participation of graduate students and researchers at various stages of their careers.

This research area, as a member of Advanced Integrated Intelligence Platform Network Laboratory (AIP Network Laboratory) that constitutes MEXT's AIP project (on Artificial Intelligence/Big Data/IoT/Cybersecurity), contributes to the research collaboration activities with the RIKEN Center for Advanced Intelligence Project I and other related research institutions.