List of research topics for NII International Internship Program 2022 2nd Call

No.	Research Area	Title of the Research	Website	Name of supervisor	Title of the supervisor	Requirements for Applicants: Master / Ph.D. Student	Total Number of Acceptance per Supervisor	Duration : 2-6months (less than 180days)	Comments
1. Principles of Informatics Research Division									
P00501	Discrete Algorithms	Fast similarity string search and their applications		Takeaki Uno	Professor	Master/Ph.D.	1	2-6months	
P01001	AI and Law	Legal Reasoning		Ken Satoh	Professor	Ph.D.	3	3 months	only after December 2022
P01002	AI and Law	Norm Compliance Mechanism		Ken Satoh	Professor	Ph.D.	3	3 months	only after December 2022
P01003	AI and Law	Online Dispute Resolution		Ken Satoh	Professor	Ph.D.	3	3 months	only after December 2022
P01101	Machine learning	Geometric analysis of machine learning	https://mahito.nii.ac.jp	Mahito Sugiyama	Associate Professor	Ph.D.	2	6 months	
P01201	Artificial Intelligence / Web Informatics	Semantic Web / Linked Data / Linked Open Data	http://lod.ac http://www-kasm.nii.ac.jp/	Hideaki Takeda	Professor	Master/Ph.D.	3	3-6months	
P01202	Artificial Intelligence / Web Informatics	Social Web / Social Media Analysis / Social Network Analysis	http://www-kasm.nii.ac.jp/	Hideaki Takeda	Professor	Master/Ph.D.	3	3-6months	
P01203	Artificial Intelligence	Artificial Social Intelligence: building intelligence systems with social knowledge and social interaction		Hideaki Takeda	Professor	Master/Ph.D.	3	3-6months	
P01301	Software verification	Separation logic	http://research.nii.ac.jp/~tatsuta/index-e.html	Makoto Tatsuta	Professor	Master/Ph.D.	2	2-6months	
P02001	Theoretical Computer Science/Data Mining	Spectral Graph Theory for Hypergraphs and Directed Graphs	https://dl.acm.org/doi/abs/10.1145/3394486.3403248 https://arxiv.org/abs/2106.02353	Yuichi Yoshida	Professor	Ph.D.	2	6 months	
P02002	Theoretical Computer Science/Data Mining	Sensitivity of Algorithms	https://arxiv.org/abs/1904.03248 https://arxiv.org/abs/2006.04094 https://arxiv.org/abs/2111.02657	Yuichi Yoshida	Professor	Ph.D.	2	6 months	
P02003	Theoretical Computer Science	Sublinear-time Algorithms	https://arxiv.org/abs/2007.07449 https://arxiv.org/abs/2204.08404	Yuichi Yoshida	Professor	Ph.D.	2	6 months	
P03401	Machine learning	Human/robot motion prediction using recurrent neural networks		Taisuke Kobayashi	Assistant Professor	Master/Ph.D.	2	3-6months	
P03402	Machine learning	Robot control using reinforcement/imitation learning		Taisuke Kobayashi	Assistant Professor	Master/Ph.D.	2	3-6months	
P03403	Robotics	Development of force-reactive robotic system		Taisuke Kobayashi	Assistant Professor	Master/Ph.D.	2	3-6months	

2. Information Systems Architecture Science Research Division									
A00301	Machine Learning, Deep Learning, Software Engineering, Testing and Debugging	Risk-Aware Debugging Techniques for Deep Neural Networks	http://research.nii.ac.jp/~f-ishikawa/en/lab.html	Fuyuki Ishikawa	Associate Professor	Master/Ph.D.	4	2-6months	
A00302	Software Engineering, Testing and Debugging, Cyber-Physical Systems, AI Systems	Smart Testing and Debugging for Cyber-Physical and Intelligent Systems	http://research.nii.ac.jp/~f-ishikawa/en/lab.html	Fuyuki Ishikawa	Associate Professor	Master/Ph.D.	4	2-6months	
A00601	Wireless and Mobile Networks, Sensing, Signal Processing, Machine Learning	Deep Learning-based wireless network design for Beyond 5G and 6G	http://research.nii.ac.jp/~megkaneko/	Megumi Kaneko	Associate Professor	Master/Ph.D.	3	4-6months	Required programming skills: Matlab, Python. Basic knowledge in wireless/digital communications and signal processing is required.
A00602	Wireless and Mobile Networks, Sensing, Signal Processing, Machine Learning	Energy efficiency optimization and energy harvesting for IoT massive connectivity	http://research.nii.ac.jp/~megkaneko/	Megumi Kaneko	Associate Professor	Master/Ph.D.	3	4-6months	Required programming skills: Matlab, Python. Basic knowledge in wireless/digital communications and signal processing is required.
A00603	Wireless and Mobile Networks, Sensing, Signal Processing, Machine Learning	Integrated terrestrial and spatial wireless communications for Beyond 5G and 6G	http://research.nii.ac.jp/~megkaneko/	Megumi Kaneko	Associate Professor	Master/Ph.D.	3	4-6months	Required programming skills: Matlab, Python. Basic knowledge in wireless/digital communications and signal processing is required.
A00604	Wireless and Mobile Networks, Sensing, Signal Processing, Machine Learning	Intelligent Reflective Surfaces (IRS), beamforming and sensing for exploiting TeraHertz bands towards 6G	http://research.nii.ac.jp/~megkaneko/	Megumi Kaneko	Associate Professor	Master/Ph.D.	3	4-6months	Required programming skills: Matlab, Python. Basic knowledge in wireless/digital communications and signal processing is required.
A00801	Wireless communications	Machine Learning-aided resource management in beyond 5G and 6G wireless networks	https://klab.nii.ac.jp	Yusheng Ji	Professor	Master/Ph.D.	2	3-6months	Knowledge on wireless communications and experiences in machine learning are preferable.
A01701	Theoretical Computer Science	Categorical Foundation of Model Checking	https://group-mmm.org/~ichiro/	Ichiro Hasuo	Professor	Master/Ph.D.	2	6 months	## Fixed-point specifications (such as in LTL and modal \mu-calculus) have been conventionally studied in terms of finitary and combinatory structures (automata, games, etc.). These observations are recently being transferred to more abstract settings, opening up algorithms and proof methods for new application domains (esp. probabilistic, metric, etc.). There are a number of research questions waiting to be answered, both theoretical and algorithmic. ## References: [Komorida, Katsumata, Hu, Klin, Hasuo, LICS'19], [Komorida, Katsumata, Kupke, Rot, Hasuo, LICS'21], [Kori, Hasuo, Katsumata, CONCUR'21], [Kori, Urabe, Katsumata, Suenaga, Hasuo, CAV'22] ## Desired: familiarity with mathematical and abstract reasoning used in logic, lattice theory and (possibly) category theory ## Interested? Please first write to me (i.hasuo [at] acm.org), with the title “NII Internship”

A01702	Theoretical Computer Science	Combining local and global propagation in quantitative model checking	https://group-mmm.org/~ichiro/	Ichiro Hasuo	Professor	Master/Ph.D.	2	6 months	## This topic is on model checking, especially its probabilistic/quantitative extension. We are specifically interested in value iteration, a family of approximate algorithms for quantitative model checking. Usual algorithms with only local propagation face certain challenges, and we have recently shown that those challenges are efficiently mitigated by mixing a right choice of global propagation. The goal is to push the idea further, to other problems and to formalization of theoretical foundations ## Reference: [Phalakarn, Takisaka, Haas, Hasuo, CAV'20]. See also the slides for my VeriProP'22 talk. ## Desired: familiarity with model checking (see e.g. [Baier & Katoen '08]), logic and automata. Familiarity with graph-theoretic algorithms is appreciated, too ## Interested? Please first write to me (i.hasuo [at] acm.org), with the title “NII Internship”
A01703	Theoretical Computer Science	Logical guidance in optimization metaheuristics	https://group-mmm.org/~ichiro/	Ichiro Hasuo	Professor	Master/Ph.D.	2	6 months	## Many real-world optimization problems have inherent logical and discrete structures, but many optimization metaheuristics (stochastic optimization, hill-climbing, evolutionary computation, etc.) do not make explicit use of such structures. We have used hierarchical optimization frameworks where the upper logical layer guides the lower metaheuristics layer for efficiency and explainability. The goal is to push the idea further in other applications and theoretical foundations. ## References: [Zhang, Hasuo, Arcaini, CAV'19], [Zhang, Ernst, Sedwards, Arcaini, Hasuo, EMSOFT'18] ## Desired: familiarity with, or eagerness to learn, 1) formal logic, 2) optimization metaheuristics, 3) statistical machine learning ## Interested? Please first write to me (i.hasuo [at] acm.org), with the title “NII Internship”
A01704	Theoretical Computer Science	Logical safety for automated driving	https://group-mmm.org/~ichiro/	Ichiro Hasuo	Professor	Master/Ph.D.	2	6 months	## Responsibility-sensitive safety (RSS) is a recently proposed methodology for devising mathematically-guaranteed safety rules for automated driving. The candidate will work on its logical foundations and its application to various driving scenarios. The work is much like interactive theorem proving, but with unique theoretical challenges (e.g. continuous dynamics) and a hot application (automated driving). ## References: [Hasuo, Eberhart, Haydon, et al., IEEE Trans. Intelligent Vehicles, ‘22 (available at arXiv)] [Shalev-Shwartz, Shammah, Shashua, arXiv'17] ## Desired: familiarity with formal logic and interactive theorem proving, passion in bringing theory to practice ## Interested? Please first write to me (i.hasuo [at] acm.org), with the title “NII Internship”

A01801	Computer network	Network security measurement and analysis	http://www.fukuda-lab.org/internship	Kensuke Fukuda	Associate Professor	Master/Ph.D.	3	5-6months	Solid programming (python or C++) and machine learning skills
A01802	Computer network	Network config/log mining	http://www.fukuda-lab.org/internship	Kensuke Fukuda	Associate Professor	Master/Ph.D.	3	5-6months	Solid programming (python) and machine learning skills
A01803	Computer network	Web privacy measurement	http://www.fukuda-lab.org/internship	Kensuke Fukuda	Associate Professor	Master/Ph.D.	3	5-6months	Solid programming skill (python or javascript)
A01804	Computer network	IoT traffic anomaly detection	http://www.fukuda-lab.org/internship	Kensuke Fukuda	Associate Professor	Master/Ph.D.	3	5-6months	Solid programming and machine learning skills

3. Digital Content and Media Sciences Research Division									
K00101	Text Media	Language Models and their applications to assist human activities	http://www-al.nii.ac.jp	Akiko Aizawa	Professor	Master/Ph.D.	4	3-6months	
K00102	Text Media	Deep analysis of scientific papers	http://www-al.nii.ac.jp	Akiko Aizawa	Professor	Master/Ph.D.	4	3-6months	
K00103	Text Media	Mathematical language processing	http://www-al.nii.ac.jp	Akiko Aizawa	Professor	Master/Ph.D.	4	3-6months	
K00401	Business intelligence	AI-driven customer intelligence	https://rb.gy/nhwgwe	Frederic ANDRES	Associate Professor	Master/Ph.D.	2	6 months	Collaboration with the largest travel company in Japan
K00402	Data science, esport	Moodflow monitoring Platform as a Service	https://rb.gy/hfbt7s	Frederic ANDRES	Associate Professor	Master/Ph.D.	2	6 months	Collaboration with Sorbonne University
K01001	Digital Humanities	Machine learning for image processing (esp. character recognition), geographic information, linked data and metadata management for cultural heritage	http://agora.ex.nii.ac.jp/~kitamoto/education/internship/	Asanobu Kitamoto	Professor	Master/Ph.D.	4	3-6months	A student with programming skills and interests in real problems is preferred.
K01002	Earth Environmental Informatics	Big data analytics (esp. image processing, remote sensing and machine learning) for societal problems such as environment and sustainability	http://agora.ex.nii.ac.jp/~kitamoto/education/internship/	Asanobu Kitamoto	Professor	Master/Ph.D.	4	3-6months	A student with programming skills and interests in real problems is preferred.
K01003	Crisis Informatics	Big data analytics (esp. image processing, natural language processing, and machine learning) for natural disasters and crisis	http://agora.ex.nii.ac.jp/~kitamoto/education/internship/	Asanobu Kitamoto	Professor	Master/Ph.D.	4	3-6months	A student with programming skills and interests in real problems is preferred.
K01004	Open Science	Research on a new trend of science, such as open data, data citation, citizen science, and open innovation	http://agora.ex.nii.ac.jp/~kitamoto/education/internship/	Asanobu Kitamoto	Professor	Master/Ph.D.	4	3-6months	A student with programming skills and interests in real problems is preferred.
K01401	Content-Based Image and Video Analysis	video and image search (esp. TRECVID AVS task. see: https://trecvid.nist.gov/)	http://www.satoh-lab.nii.ac.jp/	Shin'ichi Satoh	Professor	Master/Ph.D.	5	3-6months	
K01402	Content-Based Image and Video Analysis	Automatic question answering about videos (esp. TRECVID Deep Video Understanding (DVU). see: https://trecvid.nist.gov/)	http://www.satoh-lab.nii.ac.jp/	Shin'ichi Satoh	Professor	Master/Ph.D.	5	3-6months	
K01403	Content-Based Image and Video Analysis	Video/image captioning (esp. TRECVID Video to Text (VTT) task. see: https://trecvid.nist.gov/)	http://www.satoh-lab.nii.ac.jp/	Shin'ichi Satoh	Professor	Master/Ph.D.	5	3-6months	
K01404	Content-Based Image and Video Analysis	Disaster Scene Analysis (esp. TRECVID Disaster Scene Description and Indexing (DSDI): see https://trecvid.nist.gov/)	http://www.satoh-lab.nii.ac.jp/	Shin'ichi Satoh	Professor	Master/Ph.D.	5	3-6months	
K01405	Content-Based Image and Video Analysis	Landmark image retrieval, e.g., Google Landmark Image Retrieval https://www.kaggle.com/c/landmark-retrieval-2020.	http://www.satoh-lab.nii.ac.jp/	Shin'ichi Satoh	Professor	Master/Ph.D.	5	3-6months	
K01601	Computer Vision	One of the following topics: (1) 3D vision, (2) Human activitiy recognition, (3) Gaze sensing and navigation, (4) Object detection and segmentation from video using deep learning, and (5) Image/video generation using deep learning	http://www.dgcv.nii.ac.jp	Akihiro Sugimoto	Professor	Master/Ph.D.	5	3-6months	Rigorous background on mathematics is required. Strong programming skills on image processing and computer vision are also required. In the case of Master course students, highly motivated students who can stay for 6 months are preferable. Students who are willing to pursuit ph D at NII are preferable as well. Potential applicants should send your CV and research interests/proposals directly to Prof. Sugimoto before your application.
K01602	Digital Geometry	(1) Discretization model of geometric shape, (2) Discrete shape fitting to noisy integer points.	http://www.dgcv.nii.ac.jp	Akihiro Sugimoto	Professor	Master/Ph.D.	5	3-6months	Rigorous background on mathematics as well as computer vision is required. In particular, sufficient knowledge of linear algebra, graph theory and number theory are important requirements. Programming skills on image processing or computer vision are also required. Potential applicants should send your CV and research interests/proposals directly to Prof. Sugimoto before your application.
K01701	Data Mining	Recommender System	https://www.tlab.nii.ac.jp	Atsuhiro Takasu	Professor	Master/Ph.D.	4	4-6months	

K01702	Data Mining	Knowledge Graph Embedding	https://www.tlab.nii.ac.jp	Atsuhiro Takasu	Professor	Master/Ph.D.	4	4-6months	
K01703	Data Mining	Tabular Data Recognition and Analysis	https://www.tlab.nii.ac.jp	Atsuhiro Takasu	Professor	Master/Ph.D.	4	4-6months	
K01704	Data Mining	Sequence Data Mining	https://www.tlab.nii.ac.jp	Atsuhiro Takasu	Professor	Master/Ph.D.	4	4-6months	
K02001	Algorithms, Simulators, Designs, Token Economy (Web3)	Research and development of algorithms, simulators, and designs for Unmanned Aircraft Systems ("drone") Traffic Management (UTM), including ground risk evaluation	http://research.nii.ac.jp/~prendinger/papers/FY2022(2)_Topics.html	Helmut PRENDINGER	Professor	Master/Ph.D.	6	4-6months	We are participating in a national UTM project, where we develop a “digital twin” of areas in Japan to simulate and study realistic drone traffic. We are also interested in market design based on blockchain and token economy (Web3).
K02002	Deep Learning	(1) High-speed object detectin onboard a drone; (2) ground risk map generation for safe drone flight; (3) human detection in bad weather condition from drone perspective	http://research.nii.ac.jp/~prendinger/papers/FY2022(2)_Topics.html	Helmut PRENDINGER	Professor	Master/Ph.D.	6	4-6months	We are participating in national projects with the Advanced Robotics Foundation and the Central Research Institute of Electric Power Industry.
K02003	Deep Learning	Bitcoin (crypto) market prediction for swing trading	http://research.nii.ac.jp/~prendinger/papers/FY2022(2)_Topics.html	Helmut PRENDINGER	Professor	Master/Ph.D.	6	4-6months	This project uses publicly available sources. We focus on technical analysis and indicators.
K02301	Speech processing	Differentiable digital signal processing with applications to speech audio generation	Relevant but not limited to [1] WaveGrad https://arxiv.org/abs/2009.00713; [2] DiffWave https://arxiv.org/abs/2009.09761; [3] PriorGrad https://arxiv.org/abs/2106.06406; [4] BDDM https://arxiv.org/abs/2203.13508; [5] InferGrad https://arxiv.org/abs/2202.03751 [6] Grad-TTS https://arxiv.org/abs/2105.06337 [7] SaShiMi https://arxiv.org/abs/2202.09729 [8] https://arxiv.org/pdf/2203.16749.pdf	Junichi Yamagishi	Professor	Ph.D.	4	4-6months	The successful candidate should be a PhD student in speech processing, computer science, or a related discipline. He or she should have strong programming skills. Familiarity with DNN tools (e.g., Pytorch) and speech tools are preferable. Supervision teams include Dr. Xin Wang
K02302	Speech processing	Privacy preserving processing for speech signals including automatic generation of speaker-anonymized synthetic speech	Relevant but not limited to [1] https://www.voiceprivacychallenge.org (see 2022 evaluation plan), [2] Tomashenko, N. et al. The VoicePrivacy 2020 Challenge: Results and findings. Comput. Speech Lang. 101362 (2022) doi:10.1016/j.csl.2022.101362	Junichi Yamagishi	Professor	Ph.D.	4	4-6months	The successful candidate should be a PhD student in speech processing, computer science, or a related discipline. He or she should have strong programming skills. Familiarity with DNN tools (e.g., Pytorch) and speech tools are preferable. Supervision teams include Dr. Xin Wang and Dr. Xiaoxiao Miao
K02303	Speech processing	Generalizable and robust fake speech detection	Relevant but not limited to [1] https://www.asvspoof.org [2] Wang, X. & Yamagishi, J. A Practical Guide to Logical Access Voice Presentation Attack Detection. https://arxiv.org/abs/2201.03321 [3] ASVspoof workshop proceeding: https://www.isca-speech.org/archive/asvspoof_2021/index.html	Junichi Yamagishi	Professor	Ph.D.	4	4-6months	The successful candidate should be a PhD student in speech processing, computer science, or a related discipline. He or she should have strong programming skills. Familiarity with DNN tools (e.g., Pytorch) and speech tools are preferable. Supervision teams include Dr. Xin Wang
K02304	Speech processing	Data-efficient end-to-end speech synthesis	Relevant papers include, but are not limited to: [1] Cheng-I Jeff Lai, Erica Cooper, Yang Zhang, Shiyu Chang, Kaizhi Qian, Yi-Lun Liao, Yung-Sung Chuang, Alexander H. Liu, Junichi Yamagishi, David Cox, James Glass, "On the Interplay Between Sparsity, Naturalness, Intelligibility, and Prosody in Speech Synthesis," ICASSP 2022, and Erica Cooper, Cheng-I Lai, Yusuke Yasuda, Junichi Yamagishi, ""Can Speaker Augmentation Improve Multi-Speaker End-to-End TTS?" Interspeech 2020.	Junichi Yamagishi	Professor	Ph.D.	4	4-6months	The successful candidate should be a PhD student in speech processing, computer science, engineering, linguistics, mathematics, or a related discipline. He or she should have strong programming skills. Familiarity with DNN tools and speech tools are preferable. Supervision teams include Dr. Erica Cooper

K02305	Music processing	Instrument-specific embedding space for fine-grained timbre control of musical instrument sounds	Relevant papers include, but are not limited to: [1] Xuan Shi, Erica Cooper, Junichi Yamagishi, "Use of speaker recognition approaches for learning and evaluating embedding representations of musical instrument sounds," IEEE/ACM Trans. ASLP, Jan 2022, and Erica Cooper, Xin Wang, Junichi Yamagishi, "Text-to-Speech Synthesis Techniques for MIDI-to-Audio Synthesis," SSW 2021.	Junichi Yamagishi	Professor	Ph.D.	4	4-6months	The successful candidate should be a PhD student in speech or music signal processing, computer science, or a related discipline. He or she should have strong programming skills and experience with speech and audio processing and/or machine learning. • Familiarity with DNN tools and speech tools are preferable. Supervision teams include Dr. Erica Cooper
K02306	Music processing	Expressive multi-instrument musical performance generation using deep learning	Relevant papers include, but are not limited to: [1] Xuan Shi, Erica Cooper, Junichi Yamagishi, "Use of speaker recognition approaches for learning and evaluating embedding representations of musical instrument sounds," IEEE/ACM Trans. ASLP, Jan 2022, and Erica Cooper, Xin Wang, Junichi Yamagishi, "Text-to-Speech Synthesis Techniques for MIDI-to-Audio Synthesis," SSW 2021.	Junichi Yamagishi	Professor	Ph.D.	4	4-6months	The successful candidate should be a PhD student in speech or music signal processing, computer science, or a related discipline. He or she should have strong programming skills and experience with speech and audio processing and/or machine learning. • Familiarity with DNN tools and speech tools are preferable. Supervision teams include Dr. Erica Cooper
K02307	Natural language processing	Mitigating shortcut learning	Relevant papers include, but are not limited to: Geirhos et al., Shortcut learning in deep neural networks, Nature Machine Intelligence 2020.	Junichi Yamagishi	Professor	Ph.D.	4	4-6months	The successful candidate should be a PhD student in natural language processing, computer science/engineering, mathematics, or a related discipline, and familiar with DL frameworks (e.g., PyTorch). Supervision teams include Dr. Canasai Kruengkrai.
K02308	Natural language processing	Cross-lingual representation learning	Relevant papers include, but are not limited to: Conneau et al., Unsupervised cross-lingual representation learning at scale, ACL 2020.	Junichi Yamagishi	Professor	Ph.D.	4	4-6months	The successful candidate should be a PhD student in natural language processing, computer science/engineering, mathematics, or a related discipline, and familiar with DL frameworks (e.g., PyTorch). Supervision teams include Dr. Canasai Kruengkrai.
K02309	Natural language processing	Fact-checking over structrured and unstructured data	Relevant papers include, but are not limited to: Aly et al., FEVEROUS: Fact Extraction and VERification Over Unstructured and Structured information, NeurIPS Datasets and Benchmarks 2021.	Junichi Yamagishi	Professor	Ph.D.	4	4-6months	The successful candidate should be a PhD student in natural language processing, computer science/engineering, mathematics, or a related discipline, and familiar with DL frameworks (e.g., PyTorch). Supervision teams include Dr. Canasai Kruengkrai.
K02601	Multimedia Data Mining and Analysis	Multimodal deep learning and pre-training models for cross-modal retrieval between audio-video, lyrics-audio, and image-text, multimedia content recommendation	http://research.nii.ac.jp/~yiyu/	Yi YU	Assistant Professor	Master/Ph.D.	4	3-6months	
K02602	Artificial Intelligence and Music	Deep generative models for lyrics-to-melody generation, melody-to-lyrics generation, singing voice synthesis	https://github.com/yy1lab/Lyrics-Conditioned-Neural-Melody-Generation	Yi YU	Assistant Professor	Master/Ph.D.	4	3-6months	