2024 Summer Internship

List of Courses and Themes

March 27, 2024

Preferred Networks

List of Courses

Please refer to the recruitment instructions on our website for more details on the whole internship.

Course	4-weeks Group Dev.	10-days Short Dev.	7-weeks R&D
Period	Aug. 26th (Mon.) - Sep. 20th (Fri.)	Aug. 19th (Mon.) - Aug. 30th (Fri.) Sep. 6th (Fri.) - Sep. 20th (Fri.)	Aug. 8th (Thu.) - Sep. 27th (Fri.)
	Must participate for the entire duration in principle		Temporary absence allowed
Theme Openings	2 themes GD01～GD02	4 themes JE01～JE04	46 themes RD01～RD46

There are two categories in the 7-week R&D course according to its orientation. Please use this as a reference when choosing a theme.

Project Internship	Research Internship
An internship that engages in the tasks of projects that aim for practical problem solving, and conducts research and development of core technologies and the development of products and services	An internship that engages in pioneering and challenging research activities with the aim of submitting papers to top international conferences

The course and theme of your choice will be selected when you submit the screening task that we will guide you through after your application. The actual theme and the job content that you will work on will be decided in consultation with our team members during the selection process.

List of Themes

* IDs are non-continuous because the themes held only in Japanese are omitted from the list. If you are interested in these themes, please see the list of themes in Japanese.

ID	Theme	Area	Course	Category
GD01	[4-weeks Group Development] App/Service Development	Company Wide	4-weeks Group Dev.	-
GD02	[4-weeks Group Development] Data Science Engineering	Company Wide	4-weeks Group Dev.	-
JE04	[10-Days] Employment Experience in the Development and Operation of a web system for Matlantis, a general-purpose atomic-level simulator	Material Science / Matlantis	10-days Short Dev.	-
RD01	Machine learning research for foundation model	Foundation Model	7-weeks R&D	Research
RD02	Building a Video-Based World Model	Foundation Model	7-weeks R&D	Research
RD03	Automating Dataset Generation for LLM Pretraining	Foundation Model / Language	7-weeks R&D	Project
RD04	Acceleration of pretraining for large language model	Foundation Model / Language	7-weeks R&D	Project
RD05	Alignment of large language model	Foundation Model / Language	7-weeks R&D	Project
RD06	Development of text embedding models	Foundation Model / Language	7-weeks R&D	Project
RD07	Lightweight inference of large language models	Foundation Model / Language	7-weeks R&D	Project
RD08	Implementation of a task in the field of computer vision to a vision foundation model	Foundation Model / Vision	7-weeks R&D	Project
RD10	Development on Measurement and Analysis for the Computing Infrastructure	Computing Infrastructure / Cluster	7-weeks R&D	Project
RD11	Development of MN-Core Compiler	Computing Infrastructure / MN-Core	7-weeks R&D	Project
RD12	Development ML/HPC Application on MN-Core	Computing Infrastructure / MN-Core	7-weeks R&D	Project
RD13	Development of framework and library for deploying deep learning models in real world	Computing Infrastructure / Ecosystem	7-weeks R&D	Project
RD14	Development of CuPy	Computing Infrastructure / Cupy	7-weeks R&D	Project
RD15	AutoML for LLM	Computing Infrastructure / AutoML	7-weeks R&D	Project
RD16	Development of Optuna and Optuna Dashboard	Computing Infrastructure / Optuna	7-weeks R&D	Project
RD17	Applied research and development of machine learning and atomic simulation on materials	Material Science	7-weeks R&D	Research
RD18	Implementation of material discovery algorithms in Matlantis	Material Science / Matlantis	7-weeks R&D	Research
RD19	Development and Operation of a web system for Matlantis, a general-purpose atomic-level simulator	Material Science / Matlantis	7-weeks R&D	Project

RD20	Enhance monitoring and improve the PFP API in Matlantis, a general-purpose atomic-level simulator.	Material Science / Matlantis	7-weeks R&D	Project
RD21	Research on Neural Network Potential(NNP) in Drug Discovery	Drug Discovery	7-weeks R&D	Research
RD22	Research on machine learning models of proteins and biomolecules for drug discovery	Drug Discovery	7-weeks R&D	Research
RD23	Improving drug-likeness in machine learning based Drug Design	Drug Discovery	7-weeks R&D	Research
RD25	High-Dimensional Tabular Data Generation	Health Care	7-weeks R&D	Project
RD26	Research on machine learning methods for medical imaging	Health Care	7-weeks R&D	Research
RD27	Reconstruction, editing, and generation of 3D models and free-viewpoint videos	Entertainment / PFN 3D/4D Scan	7-weeks R&D	Project
RD28	Reconstruction, editing, and generation of 3D models and free-viewpoint videos	Entertainment / PFN 3D/4D Scan	7-weeks R&D	Research
RD30	Application of Generative AI Technologies to Creativity	Entertainment / Creative	7-weeks R&D	Research
RD39	Research and Development of Advanced Segmentation Methods for SAR Images	Satellite Image	7-weeks R&D	Project
RD40	Research and development on the estimation/prediction of various weather conditions using the advanced high-spatio-temporal resolution 3D weather data	Meteorology	7-weeks R&D	Project
RD41	Beyond BackPropagation : Attack on the Current SGD based algorithms	Deep Learning	7-weeks R&D	Research
RD42	Beyond Group Equivariant Framework: Extending Neural Fourier Scheme to non-group structure	Deep Learning	7-weeks R&D	Research
RD43	Optimizing the latent space for Flow based algorithms	Deep Learning	7-weeks R&D	Research
RD44	Extended Reality (VR, MR, AR) x AI	HCI	7-weeks R&D	Research
RD45	Interactive Systems in HCI for Generative AI	HCI	7-weeks R&D	Research

GD01
[4-weeks Group Development] App/Service Development

Area: Company Wide
Course: 4-weeks Group Development Course

We are seeking individuals who have experience in application development, regardless of their research and development experience in machine learning and generative AI. The selected candidates will work in groups of approximately 3-4 people, collaborating with a mentor who is a PFN employee, to plan and develop services utilizing generative AI such as Language Model.

Communication Language

English/Japanese

Must Requirements

- Basic skills in programming
- Basic knowledge in computer science

Preferred Requirements

- Development experience in applications and web services. When applying, please provide a portfolio, including examples of applications.
- Ability to independently plan and conceptualize applications
- Communication skills in Japanese

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GD02
[4-weeks Group Development] Data Science Engineering

Area: Company Wide
Course: 4-weeks Group Development Course

You will be working on a task that involves predicting precipitation using cutting-edge meteorological radar data called MP-PAWR in a team with 3 to 4 people. We will evaluate not only the accuracy of the precipitation forecast but also the insights and observations obtained through the data analysis process.

Communication Language

English/Japanese

Must Requirements

- Familiarity with Python
- Basic knowledge in computer science

Preferred Requirements

- Communication skills in Japanese
- Experience in data analysis

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JE04
[10-Days] Employment Experience in the Development and Operation of a web system for Matlantis, a general-purpose atomic-level simulator

Area: Material Science / Matlantis
Course: 10-days Short Development Course

Work on the development and operation of Matlantis features. (e.g., improving release methodology, investigating and optimizing API Gateway scheduling, cross-document search, developing JupyterLab extensions, etc.)

Communication Language

English/Japanese

Must Requirements

- Basic knowledge in computer science
- Familiarity with Python or Go

Preferred Requirements

- Experience with cloud computing (AWS/GCP/Azure, etc.)
- Knowledge of container orchestration systems (Kubernetes)
- Client and server model implementation (REST/gRPC/GraphQL, etc.)
- Experience with tools that enable Infrastructure as Code (Terraform / CloudFormation)

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RD01
Machine learning research for foundation model

Area: Foundation Model
Course: 7-weeks Research & Development Course
Category: Research Internship

We are looking for a self-driven candidate to join us in our research on foundation models, including LLM. Prospective topics may include Training dynamics, In-context learning / Chain-of-Thoughts as well as comprehensive investigation of existing models and datasets.
We welcome students who can independently set research themes and carry out research projects.

Communication Language

English/Japanese

Must Requirements

- Familiarity with the Python programming
- Experience in Deep Learning framework such as PyTorch
- Good understanding of machine learning

Preferred Requirements

- Knowledge about a foundation model

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RD02
Building a Video-Based World Model

Area: Foundation Model
Course: 7-weeks Research & Development Course
Category: Research Internship

We aim to construct a neural network model that can learn the rules governing its environment from video data, enabling it to predict future events and take action accordingly.

Communication Language

English/Japanese

Must Requirements

- Experience in implementation using deep learning frameworks such as PyTorch
- Theoretical knowledge in relevant fields such as algebra, operators, harmonic analysis, signal analysis, etc.
- Strong interest in recent research related to invariance/equivariance on machine learning

Preferred Requirements

- Currently enrolled in a doctoral program
- Co-responsible paper(s) accepted at premier international conferences or in English scientific journals (not necessarily limited to the field of machine learning)
- Research experience in the fields of physics and computer vision

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RD03
Automating Dataset Generation for LLM Pretraining

Area: Foundation Model / Language
Course: 7-weeks Research & Development Course
Category: Project Internship

You will develop methods for automatically generating and filtering training datasets, aimed at achieving high-efficiency and high-quality LLMs. This project focuses on the following three items:

(1) Thorough investigation of the data's impact on performance

(2) Development of dataset generation methods to maximize training efficiency

(3) Pre-training of LLM using the generated dataset

Communication Language

English/Japanese

Must Requirements

- Basic knowledge of computer science
- Experience in developing applications using LLMs, regardless of scale

Preferred Requirements

- Experience in software development within a team setting
- Accomplishments in the field of Machine Learning, such as paper presentations or achievements in competitions
- Specialized knowledge in Natural Language Processing (NLP)

- Experience with pre-training LLMs

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RD04
Acceleration of pretraining for large language model

Area: Foundation Model / Language
Course: 7-weeks Research & Development Course
Category: Project Internship

Accelerate performance of pretraining for deploying LLMs. We assume the implement MoE (Mixture of Experts) or expanding context length in this theme.

Communication Language

English/Japanese

Must Requirements

- Basic knowledge in computer science
- Coding skills in Python

Preferred Requirements

- Experience in accelerating in deep learning application
- Experience in implementing Transformers model, and/or knowledges of the model
- Experience implementing distributed parallel application with multi-GPUs in deep learning

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RD05
Alignment of large language model

Area: Foundation Model / Language
Course: 7-weeks Research & Development Course
Category: Project Internship

Conduct R&D regarding the alignment / instruction tuning of LLMs (Large Language Models).
We mean by alignment of LLMs a process of ensuring them to produce desired outputs people want to use in real-life applications.
Specifically, we are considering themes such as:

- Evaluation of data quality by LLM, etc. (AI feedback)
- Synthetic data generation by LLM
- Fine-tuning of LLM by reinforcement learning (DPO, PPO, etc.)

Communication Language

English/Japanese

Must Requirements

- Basic knowledge in machine learning
- Coding skills in Python
- Experience in Deep Learning framework such as PyTorch

Preferred Requirements

- Knowledge and experience in LLMs

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RD06
Development of text embedding models

Area: Foundation Model / Language
Course: 7-weeks Research & Development Course
Category: Project Internship

Develop text embedding models for downstream tasks such as RAG and text classification.

Communication Language

English/Japanese

Must Requirements

- Basic knowledge in computer science
- Coding skills in Python

Preferred Requirements

- Knowledge in natural language processing
- Experience in Hugging Face Transformers and Sentence Transformers

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RD07
Lightweight inference of large language models

Area: Foundation Model / Language
Course: 7-weeks Research & Development Course
Category: Project Internship

Accelerate inference and reduce memory usage in deploying LLMs. Our goal is to enable the deployment of 100B/1T-class LLMs on lightweight computational resources through various approaches, including model compression techniques such as distillation, pruning, and quantization, as well as improvements in implementation layers.

Communication Language

English/Japanese

Must Requirements

- Basic knowledge in computer science
- Coding skills in Python

Preferred Requirements

- Experience in accelerating and/or reducing memory usage in deep learning deployment
- Knowledge of model compression techniques such as distillation, pruning, and quantization
- Coding skills in C++ and/or CUDA
- Experience with distributed data processing in multi-GPU environments

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RD08
Implementation of a task in the field of computer vision to a vision foundation model

Area: Foundation Model / Vision
Course: 7-weeks Research & Development Course
Category: Project Internship

Implement a task in the field of computer vision, such as semantic segmentation or instance segmentation, in a vision foundation model. Specific tasks and approaches to implementation will be decided in consultation with team members.

Communication Language

English/Japanese

Must Requirements

- Basic knowledge of computer vision
- Programming in Python

Preferred Requirements

- Research and development experience in the field of computer vision
- Experience in research and development related to the machine learning field
- Basic knowledge of large language models
- Experience with deep learning frameworks

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RD10
Development on Measurement and Analysis for the Computing Infrastructure

Area: Computing Infrastructure / Cluster
Course: 7-weeks Research & Development Course
Category: Project Internship

You will work on research and development on measurement and analysis systems for the computing infrastructure. Your main task would be:

- Fine-grained network measurement utilizing (by telemetry or FPGA)
- Traffic engineering for RoCEv2
- Development of a job generator for infrastructure evaluation
- Fine-grained power measurement for accelerator based systems

Communication Language

English/Japanese

Must Requirements

- Basic knowledge of computer science

Preferred Requirements

- Knowledge and experience of computer network
- Knowledge and experience of kubernetes
- Experience of FPGA/Microcontroller development

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RD11
Development of MN-Core Compiler

Area: Computing Infrastructure / MN-Core
Course: 7-weeks Research & Development Course
Category: Project Internship

You will work on MN-Core compiler and related toolchain improvements. Your main task would be:

- Improvement of MN-Core compiler algorithm
- Development toolchain for MN-Core

Communication Language

English/Japanese

Must Requirements

- Basic knowledge of computer science
- Experience of Python, C++

Preferred Requirements

- Experience of low level performance optimization
- Knowledge and experience of deep learning compiler stack

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RD12
Development ML/HPC Application on MN-Core

Area: Computing Infrastructure / MN-Core
Course: 7-weeks Research & Development Course
Category: Project Internship

You will work on ML/HPC application porting for MN-Core accelerator. Your main task would be development for :

- Library for HPC (e.g. LAPACK)
- HPC Application (e.g. Atmospheric Model, Molecular Dynamics or RNA secondary structure prediction)
- ML workload

You can collaborate with compiler-core developer if you need it.

Communication Language

English/Japanese

Must Requirements

- Basic knowledge of computer science
- Experience of Python, C++

Preferred Requirements

- Experience of low level performance optimization
- Experience on application development/porting for accelerator-based HPC system

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RD13
Development of framework and library for deploying deep learning models in real world

Area: Computing Infrastructure / Ecosystem
Course: 7-weeks Research & Development Course
Category: Project Internship

Develop compiler/runtime (PFVM) that optimizes computational graphs of deep learning models to perform inference performantly (in terms of execution time and memory usage), targetting on various backends such as CUDA or edge devices.

Communication Language

English/Japanese

Must Requirements

- Programming in Python
- Basic knowledge of computer science
- Basic knowledge of compiler

Preferred Requirements

- Programming in C++
- Experience on deep learning compilers (ONNX, LLVM, MLIR, etc.)
- Development experience of multi-pass compilers
- Basic knowledge of optimization algorithms

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RD14
Development of CuPy

Area: Computing Infrastructure / Cupy
Course: 7-weeks Research & Development Course
Category: Project Internship

In this project, you will work on development of CuPy, an open-source array library for GPU. (1) Development of new features for performance improvement, (2) Implementation of a prototype for new GPU backends (e.g., Metal, oneAPI), (3) Enhancing SciPy compatible APIs.

Communication Language

English/Japanese

Must Requirements

- Programming in CUDA
- Programming in Python and NumPy
- Basic knowledge of computer science

Preferred Requirements

- Experience with distributed data processing in multi-GPU environments (NCCL, MPI, etc.)
- Development experience with Metal Shading Language

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RD15
AutoML for LLM

Area: Computing Infrastructure / AutoML
Course: 7-weeks Research & Development Course
Category: Project Internship

You will join the development of AutoML technologies aimed at maximizing the performance of LLMs. Specifically, you will work on algorithm development and experiments on the following themes: (1) Prompt optimization, (2) Hyperparameter optimization of systems utilizing LLMs.

Communication Language

English/Japanese

Must Requirements

- Basic knowledge of computer science
- Experience in developing applications using LLMs

Preferred Requirements

- Experience in software development and support in a multi-person team
- Achievements in the field of LLM, such as paper presentations and competition results
- Expertise on Natural Language Processing (NLP)

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RD16
Development of Optuna and Optuna Dashboard

Area: Computing Infrastructure / Optuna
Course: 7-weeks Research & Development Course
Category: Project Internship

You will work on the automatic hyperparameter optimization framework, Optuna and Optuna Dashboard, focusing on (1) implementing new algorithms, (2) improving software quality and design, and/or (3) enhancing open-source software (OSS) operations.

Communication Language

English/Japanese

Must Requirements

Basic knowledge of computer science

Preferred Requirements

- Contribution to open-source software development, or similar achievements
- Experience in software development and support in a multi-person team
- Achievements in the field of machine learning, such as paper presentations and competition results
- Expertise on Bayesian optimization and black-box optimization algorithms
- Experience in modern web front-end development
- Experience in UI/UX design

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RD17
Applied research and development of machine learning and atomic simulation on materials

Area: Material Science
Course: 7-weeks Research & Development Course
Category: Research Internship

Will work on the development of machine learning based atomic simulator, or the application of machine learning to molecular dynamics calculations and materials exploration techniques. In addition to this theme, there is another theme which focuses more on implementation and development (RD18). You can discuss which theme to join after application.
Reference: Matlantis https://matlantis.com/

Communication Language

English/Japanese

Must Requirements

- Basic knowledge of computer science
- Basic knowledge or interest of physic, chemistry, or material science

Preferred Requirements

- Knowledge of college degree in physics, chemistry, or materials science
- Computational science experience. For example, in-depth knowledge of and experience implementing and using simulation techniques such as quantum chemical calculations, molecular dynamics methods, etc.
- Experience in research and development and writing papers on the integration of physical simulation and machine learning

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RD18
Implementation of material discovery algorithms in Matlantis

Area: Material Science / Matlantis
Course: 7-weeks Research & Development Course
Category: Research Internship

You may conduct tasks such as implementing and evaluating computational chemistry and data science-based methods for physical property or structure predictions. In addition to this theme, there are also themes that focus more on research (RD17), service provision (RD19), and inference API provision (RD20). We can discuss which theme to join after application.
Reference: Matlantis: https://matlantis.com/

Communication Language

English/Japanese

Must Requirements

- Coding skills in Python
- Basic knowledge of computer science
- Interest in physics, chemistry, or material science

Preferred Requirements

- Motivation to bring value to customers and connect academic research to actual products
- College-level knowledge in physics, chemistry, or materials science
- Computational chemistry experience. For example, knowledge or usage of simulation techniques such as quantum chemical calculations, molecular dynamics methods, etc.
- Research or publication experience

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RD19
Development and Operation of a web system for Matlantis, a general-purpose atomic-level simulator

Area: Material Science / Matlantis
Course: 7-weeks Research & Development Course
Category: Project Internship

Work on the development and operation of Matlantis features. (e.g., improving release methodology, investigating and optimizing API Gateway scheduling, cross-document search, developing JupyterLab extensions, etc.)

Communication Language

English/Japanese

Must Requirements

- Basic knowledge in computer science
- Familiarity with Python or Go

Preferred Requirements

- Experience with cloud computing (AWS/GCP/Azure, etc.)
- Knowledge of container orchestration systems (Kubernetes)
- Client and server model implementation (REST/gRPC/GraphQL, etc.)
- Experience with tools that enable Infrastructure as Code (Terraform / CloudFormation)

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RD20
Enhance monitoring and improve the PFP API in Matlantis, a general-purpose atomic-level simulator.

Area: Material Science / Matlantis
Course: 7-weeks Research & Development Course
Category: Project Internship

Work on strengthening the monitoring of the most critical inference API in the Matlantis service to discover bottlenecks and optimize the speed of inference.

Communication Language

English/Japanese

Must Requirements

- Basic knowledge in computer science
- Familiarity with Python or Go

Preferred Requirements

- Experience with cloud computing (AWS/GCP/Azure, etc.)
- Knowledge of container orchestration systems (Kubernetes)
- Client and server model implementation (REST/gRPC/GraphQL, etc.)
- Experience with tools that enable Infrastructure as Code (Terraform / CloudFormation)

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RD21
Research on Neural Network Potential(NNP) in Drug Discovery

Area: Drug Discovery
Course: 7-weeks Research & Development Course
Category: Research Internship

In recent years, there has been a growing demand for research on NNP in drug discovery. Additionally, there is a need for further improved accuracy, addition of new functionalities, and further validation in drug discovery. In this program, you will work to solve these challenges by utilizing the Preferred Potential (PFP) developed by our company and ENEOS Corpo., or by developing a novel NNP. You CANNOT apply in duplicate with RD22 or RD23.

Communication Language

English/Japanese

Must Requirements

- Knowledge of basic computational science
- Experience in implementing deep learning models using frameworks like PyTorch.

Preferred Requirements

- Experience in Quantum Chemistry
- Knowledges in Chemistry, Biology, or Physics

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RD22
Research on machine learning models of proteins and biomolecules for drug discovery

Area: Drug Discovery
Course: 7-weeks Research & Development Course
Category: Research Internship

You will work on machine learning models of proteins and biomolecules related to drug discovery.
Specifically, you will (1) conduct research on the application of protein language models (pLM) to drug discovery, (2) protein design, and (3) study models for generating 3D structures and sequences of proteins and other biomolecules. You CANNOT apply in duplicate with RD21 or RD23.

Communication Language

English/Japanese

Must Requirements

- Knowledge of basic computer science
- Expertise in chemistry, biology or physics (e.g. organic chemistry / medicinal chemistry / structural biology / molecular simulation)

Preferred Requirements

- Research background in deep learning (papers/conference presentations are highly desirable)
- Experience in applying machine learning and data science in the fields of chemistry, biology, or physics (papers and conference presentations are highly desirable)
- Experience in writing papers and implementing models and algorithms

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RD23
Improving drug-likeness in machine learning based Drug Design

Area: Drug Discovery
Course: 7-weeks Research & Development Course
Category: Research Internship

When designing a potential candidate for a drug, drug likeness is used to quantify a set of key molecular characteristics that have to be considered. It is favorable to accurately predict such values and incorporate it in the designing process. Potential research directions for this topic are: 1) Finding an effective way to condition the generative process with drug-likeness or similar metric, 2) making more accurate predictions. You CANNOT apply in duplicate with RD21 or RD22.

Communication Language

English/Japanese

Must Requirements

- Knowledge of basic computer science
- Expertise in chemistry, biology or physics (e.g. organic chemistry / medicinal chemistry / structural biology / molecular simulation)

Preferred Requirements

- Research background in deep learning (publication record/conference presentations are highly desirable)
- Experience in predicting, interpreting or analysis of ADME/Pharmacokinetics/Pharmacodynamics/toxicity data.
- Experience in applying machine learning and data science in the fields of chemistry, biology, or physics (papers and conference presentations are highly desirable)
- Experience in writing papers and implementing models and algorithms

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RD25
High-Dimensional Tabular Data Generation

Area: Health Care
Course: 7-weeks Research & Development Course
Category: Project Internship

Tabular data generation can be useful in many applications, including healthcare. In general, tabular data has various types of attributes taking continuous values or discrete values. However, existing results typically use benchmark datasets, which have a small number of attributes (d <= 50). In this internship theme, we want to explore the performance of tabular data generation methods in higher dimension (d > 100) setting.

Communication Language

English/Japanese

Must Requirements

- Familiarity with the Python programming
- Experience in Deep Learning framework such as PyTorch
- Good understanding of machine learning

Preferred Requirements

- Capability of propelling your R&D projects proactively and in a self-motivated manner: identify problems, analyze causes, devise solutions
- Experiences in writing a technical paper

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RD26
Research on machine learning methods for medical imaging

Area: Health Care
Course: 7-weeks Research & Development Course
Category: Research Internship

We will develop machine learning methods to solve problems in the medical imaging domain (e.g. applications of foundation models, domain generalization, survey of novel models etc.).

Communication Language

English/Japanese

Must Requirements

- Deep knowledge of image analysis methods
- Coding skills in Python
- Experience using deep learning frameworks such as PyTorch

Preferred Requirements

- Knowledge of biology equivalent to at least undergraduate level
- Experience of research with images or video data
- Publishing papers in the field of biology, mathematics, or informatics
- Experience developing applications using machine learning or deep learning

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RD27
Reconstruction, editing, and generation of 3D models and free-viewpoint videos

Area: Entertainment / PFN 3D/4D Scan
Course: 7-weeks Research & Development Course
Category: Project Internship

At PFN, we focus on improving and extending the technology related to 3D reconstruction (https://pfn3d.com/) and free-view rendering (https://pfn3d.com/4d/index.html). Our research and development covers various areas including machine learning-based reconstruction techniques as well as various editing and generation technologies.
You CANNOT apply in duplicate with RD28.

Communication Language

English/Japanese

Must Requirements

- Proficiency in coding using Python.
- Experience with deep learning frameworks such as PyTorch.
- Knowledge in computer vision and 3D-related topics.

Preferred Requirements

- Knowledge and research experience in 3D reconstruction, free viewpoint image generation, CG, AR/VR, video production, and camera-related topics.
- Experience with 3DCG production software.

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RD28
Reconstruction, editing, and generation of 3D models and free-viewpoint videos

Area: Entertainment / PFN 3D/4D Scan
Course: 7-weeks Research & Development Course
Category: Research Internship

At PFN, we focus on improving and extending the technology related to 3D reconstruction (https://pfn3d.com/) and free-view rendering (https://pfn3d.com/4d/index.html). Our research and development covers various areas including machine learning-based reconstruction techniques as well as various editing and generation technologies. We highly encourage students who have the ability to independently conduct research projects.
You CANNOT apply in duplicate with RD27.

Communication Language

English/Japanese

Must Requirements

- Proficiency in coding using Python.
- Experience with deep learning frameworks such as PyTorch.
- Knowledge in computer vision and 3D-related topics.

Preferred Requirements

- Track record of presenting research at international conferences and/or publishing in academic journals.
- Knowledge and research experience in 3D reconstruction, free viewpoint image generation, CG, AR/VR, video production, and camera-related topics.
- Experience with 3DCG production software.

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RD30
Application of Generative AI Technologies to Creativity

Area: Entertainment / Creative
Course: 7-weeks Research & Development Course
Category: Research Internship

Engage users; inspire creators.
In this project, you will participate in research and development at Entertainment team that aims to realize new creative expressions through the fusion of human creativity and AI technology.

Communication Language

English/Japanese

Must Requirements

Required skills:

- Coding ability using Python

In addition to the above, one of the following specialist skills or practical experience:

- Development experience using machine learning libraries such as PyTorch
- Research accomplishments in the field of machine learning, such as paper publications
- Advanced implementation ability and development experience in frontend / backend / applications

Preferred Requirements

- Experience in OSS activities, R&D, or paper writing related to generative AI technology
- Practical experience in Kubernetes or cloud computing
- Experience in system design, product design, or UI/UX design
- Interest in entertainment (anime, games, etc.)

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RD39
Research and Development of Advanced Segmentation Methods for SAR Images

Area: Satellite Image
Course: 7-weeks Research & Development Course
Category: Project Internship

SAR (Synthetic Aperture Radar) images, capturing ground conditions by irradiating electromagnetic waves from satellites and aircraft, are expected to be applicable for tasks like verifying the condition in times of disaster due to their ability to operate under any weather or night conditions. In this internship theme, your research will involve using domain adaptation, weakly-supervised learning, and self-supervised learning to improve segmentation task performance by leveraging a large amount of remote sensing data (SAR and optical images from satellites and aircraft) obtained from various sensors.

Communication Language

English/Japanese

Must Requirements

- Proficiency in machine learning using deep learning
- Experience in R&D of machine learning models using PyTorch
- Capability to tackle research issues proactively and ambitiously

Preferred Requirements

- Experience in R&D related to computer vision, particularly segmentation
- Technical understanding and R&D experience related to satellite images
- Knowledge about domain adaptation, weakly-supervised learning, and self-supervised learning
- Experience in development with multi GPUs
- Experience in code management utilizing Git/GitHub
- Experience using GIS data and related libraries
- Having experience with Docker/Kubernetes
- Ability to actively communicate within a small team
- Experience in writing research papers
- Readiness to engage in R&D activities that start from collection and

preparation of datasets

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RD40
Research and development on the estimation/prediction of various weather conditions using the advanced high-spatio-temporal resolution 3D weather data

Area: Meteorology
Course: 7-weeks Research & Development Course
Category: Project Internship

We are collaborating with NICT to analyze the advanced high-spatio-temporal resolution 3D weather radar, which NICT developed recently. Interns will be expected to engage research tasks that can take leverage of this rich and massive radar data. Possible tasks are: quantitative precipitation estimation, precipitation particle classification, lightening localization and prediction, 3D wind estimation, and others.

Communication Language

English/Japanese

Must Requirements

- Expertise in Deep Learning-based machine learning
- Good experiences in developing machine learning models in PyTorch
- Capability of propelling your R&D projects proactively and in a self-motivated manner: identify problems, analyze causes, devise solutions

Preferred Requirements

- Experiences in writing a technical paper
- Knowledgeable about physics of whether and atmosphere
- Mathematical skill to formulate and approximate physical phenomenon into statistical models
- R&D experiences in a multi-person team with Git, Github
- R&D experiences with virtual container/environment such as Docker, and Kubernetes
- Development experiences on GPU clusters (private or public)
- Experiences dealing with GIS data and related libraries, softwares

- Accustomed to command-line interfaces in Linux and/or Mac
- Eager to start R&D activities from collecting and organizing your own dataset
- Team working and communications skills

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RD41
Beyond BackPropagation : Attack on the Current SGD based algorithms

Area: Deep Learning
Course: 7-weeks Research & Development Course
Category: Research Internship

We are looking for a candidate who will be excited to work with us on developing an alternative to Back Propagation from both mathematical and computational perspectives!

Communication Language

English/Japanese

Must Requirements

Interest in the alternatives to BackPropagation, Knowledge in related fields of Mathematics/Physics/CS, experience in programming (PyTorch).

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RD42
Beyond Group Equivariant Framework: Extending Neural Fourier Scheme to non-group structure

Area: Deep Learning
Course: 7-weeks Research & Development Course
Category: Research Internship

We are looking for a candidate interested in unsupervised learning of symmetry strucutre. We are looking for a way to go beyond "group". Join us in our challenging endeavor!

Communication Language

English/Japanese

Must Requirements

Knowledge in related Mathemtical Fields (Algebra, Category, Geometry, etc), Programming experience, Interest in Symmetry learning and Equivariance Relation

Preferred Requirements

Research experience in the field of equivariance learning

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RD43
Optimizing the latent space for Flow based algorithms

Area: Deep Learning
Course: 7-weeks Research & Development Course
Category: Research Internship

We are looking for a way to choose "a good latent space" suited for the training of flow-based generative models, which are dominating the world today. We are looking for candidates who are excited to work on this project from both a theoretical and computational perspective.

Communication Language

English/Japanese

Must Requirements

Theoretical Understanding of Flow-Matching/ Diffusion Models, or the knowledge in related mathematical fields (SDE/PDE,etc) , Programming Experience

Preferred Requirements

Experience of learning a large model

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RD44
Extended Reality (VR, MR. AR) x AI

Area: HCI
Course: 7-weeks Research & Development Course
Category: Research Internship

Research and develop novel XR experiences powered by AI, in particular LLMs and generative AI.

Communication Language

English/Japanese

Must Requirements

Experience developing XR applications

Preferred Requirements

- Proven track record of XR application development, e.g. projects on Github, apps, games, research prototypes etc.
- Familiarity with generative AI tools and their APIs
- Publications at HCI/XR conferences or journals

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RD45
Interactive Systems in HCI for Generative AI

Area: HCI
Course: 7-weeks Research & Development Course
Category: Research Internship

Research and develop novel interactive systems for leveraging generative AI

Communication Language

English/Japanese

Must Requirements

- Research experience in HCI/ML/CV/NLP/Numerical Optimization

Preferred Requirements

- Proven track record of interactive application development, e.g. projects on Github, apps, games, research prototypes etc.
- Familiarity with generative AI tools and their APIs
- Publications at conferences or journals

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