

31691081-022

O R e s e a r c h a n d E x p e r i m e n t s I (E) - 2 2

2 単位/Unit 春集中/Spring Intensive 京田辺/Kyotanabe 実験/Experiment

Research and Experiments I (E)-22

大崎 美穂

<概要/Course Content Summary >

In our laboratory, we develop technologies for machine learning, knowledge discovery, and multimedia understanding with the aim to improve human collaboration and productivity by supporting intellectual activities. We also apply the findings of the basic research to the fields of medical informatics and education. As a research environment, high performance cloud service platforms such as AWS and calculation servers equipped with many cores and GPUs are available to carry out computational experiments and simulations. Under the supervision of the professor, you will be part of the laboratory group, decide upon a research theme in the following list, and conduct your master's research on your own initiative. The specific steps in the research process are described below.

[[Research Themes]]

(1) Development of Machine Learning and Knowledge Discovery Methods

[Themes on Time Series]

(1)-1: Methods to analyze biomedical signals based on signal processing and time series deep learning.

(1)-2: Methods to generate basis functions based on deep unfolding and self-supervised learning.

[Themes on imbalance]

(1)-3: Deep neural networks for imbalanced data classification based on the confusion matrix.

(1)-4: Satellite image recognition using the imbalanced data classifier.

[Themes on dependence and causality]

(1)-5: Methods for nonlinear dependence discovery based on neural networks with the L1 regularization.

(1)-6: Methods for nonlinear causality discovery by the expansion of dependence discovery methods.

(2) Development of Multimedia Understanding Methods

[Themes on Cognitive System Modeling]

(2)-1: Matching of image regions and words/phrases based on attention mechanism.

(2)-2: Modeling of memory mechanism during video viewing.

(2)-3: Data augmentation by modeling human's imagination process.

[Themes on Multimodal Analysis]

(2)-4: Integration, imputation, and correspondence among data of different modalities.

(2)-5: Building a question-answering system based on data from multimodalities.

(2)-6: Intention inference through natural interaction between a user and a system.

(3) Development and Application of Intellectual Activity Support Systems to Medical Informatics and Education

[Themes on Medical and Health Care]

(3)-1: Brain occlusion inference using pulse waves.

(3)-2: Bone quality inference using ultrasonic waves.

(3)-3: Biomedical signal analysis with medical explainability.

[Themes on Education]

(3)-4: Data mining for STEM education.

(3)-5: Verification of knowledge consistency among different information sources.

[[Research Process]]

使用システム/System tools

e-class, Teams, Panopto

<成績評価基準/Evaluation Criteria >

Research Activities 50%

Evaluation is done by the supervisor based on your attitude towards and performance in seminars, workshops, literature survey, self-directed learning, and the conduction of research.

Research Contents and Results 50%

Evaluation is done by the supervisor and examiners based on whether your work presented in the master's thesis and defense is appropriate for a master's degree, regarding research ideas for problem solving, developed methods and systems, and performed experiments and analyses.

<連絡方法/Contact method >

科目担当者への連絡方法/Contact method from student to instructor

Face-to-face, Email, Microsoft Teams, Zoom, Slack etc.

科目担当者からの連絡方法/Contact method from instructor to students

Face-to-face, Email, Microsoft Teams, Zoom, Slack etc.