2021/07/01 update

Courses taught in Toyohashi University of Technology

Human Sensation & Perception (4 ECTS) - Lighting Track

1st quarter

Course instructor: Prof. Shigeki Nakauchi

Aims:
1st quarter of this course is designed to introduce students to the scientific study of human nature. Students will learn why and how scientists ask question about the sensation and perception and the relation of brain and behavior. Students will also learn about the research methods to measure the perception and cognition used in the field of psychology and cognitive science. Finally, students will be able to create their own experiments using the '*OpenSesame*', worldwide well-known software for creating experiments for psychology, cognitive science, neuroscience and experimental economics.

Content:
1. Introduction to "Science of Human Sensation and Perception"
2. Video (MIT open courseware) and short quiz
3. Measuring Perception – research methodology –
4. Short quiz and Online experiment
5. Workshop for creating experiments using *OpenSesame*
6. Perform experiment and analyze your own data
7. Perform experiment and analyze your own data
8. Wrap up the 1st quarter

2nd quarter

Course instructor: Assoc. Prof. Kowa Koida

Aims:
After the course, students will be able to understand the structure and function of the sensory systems and how sensation and perception work together to help us to guide our behavior. Course on physiological mechanisms for sensation and perception. The course covers from receptors to the cortex and beyond.

Content:
1. visual sensor
2. auditory sensor
3. Tactile and chemical sensors
4. Cognition and brain function
5. Behavior
6. Reading Kandel, chapter 1
7. Reading Kandel, chapter 2

X Reality and Psychology (4 ECTS) - Lighting Track

1st quarter

Course instructor: Prof. Michiteru Kitazaki

Aims:
After completing the course, students will understand the principles of X reality (cross reality: XR) including virtual reality (VR), mixed reality (MR), and augmented reality (AR) in psychological, physiological, and functional aspects. They will also be able to understand the benefits and challenges of VR/MR/AR/XR on future society.

Content:
X Reality including Virtual Reality, Mixed Reality, and Augmented Reality will be explained about its mechanisms and functions not only in the engineering perspective but also psychological perspective. The final part of the class is composed of students' presentations of their original application, device or idea on X Reality and the discussion on it.

1. Introduction to XR and Psychology
2. Two components of reality
3. Visual reality, Mixed Reality and Augmented reality
4. Multi- and Cross-modality phenomenon
5. Embodied cognition and Augmented human
6. Exploring cyberspace
7. Presentations by students and Discussion
8. Presentations by students and Discussion

2nd quarter

Course instructor: Prof. Tetsuto Minami / Assoc. Prof. Toshie Matsui

Content:
Lectures and project works related topics on X reality and Psychology I (1st quarter): visual cognition, auditory cognition, tactile and other modality cognition, cross-modal cognition, VR, MR, and AR.

1. Introduction -- Prof. Minami
2. Methods of X reality and Psychology -- Prof. Minami
3. EEG -- Prof. Minami
4. Eye-tracking -- Prof. Minami
5. Spatial hearing -- Assoc. Prof. Matsui
6. Binaural hearing and sound reality -- Assoc. Prof. Matsui
7. Interaction between the visual and auditory system -- Assoc. Prof. Matsui
8. Presentation: examples of the illusion by multisensory integration -- Assoc. Prof. Matsui

Robotic Perception and Human-Robot Interaction (4 ECTS) - Computational Imaging Track

1st quarter

Course instructor: Prof. Jun Miura

Aims:
Fundamental and advanced issues in intelligent robotics will be discussed. Topics included are: statistical sensor fusion with Bayes filters, object tracking and identification, robotic mapping and localization, observation planning, human detection and identification, and task-oriented human-robot interaction.

Content:
1. Introduction, probability basics, and sensor fusion by Bayesian inference.
2. Object tracking by Bayesian filters.
3. Mobile robot localization.
4. Mapping and SLAM (simultaneous localization and mapping)
5. Observation planning.
6. Human detection and identification.
7. Task-oriented human-robot interaction.
8. Presentation of assignment

2nd quarter

Course instructor: Assoc. Prof. Ren Omura / Lecturer Naoki Oshima

Aims:
The aim of this course is to utilize tools and platforms to construct human-robot affective communication in a real-world scenario.

Content:

1. Building interactive sociable robots of the future, On-demand (Dr. Ohshima)
2-3. Real-time multimodal processing for constructing sociable robot's conversation system (Dr. Ohshima)
4. Network services for sociable robot manipulation, On-demand (Dr. Ohmura)
5. 3D robot printing technology, On-demand (Dr. Ohshima)
6-7. Final assignment (project work: proposing and prototyping sociable robots of the future), evaluation and review (Dr. Ohshima)

3D Vision Computation (4 ECTS) - Computational Imaging Track

1st quarter

Course instructor: Assoc. Prof. Yasushi Kanazawa

Aims:
This course involves fundamentals and advanced issues on 3D reconstruction from images based on geometry.

Content:
1. Introduction and Projective Geometry
2. Epipolar Geometry
3. 3D reconstruction from Two Views
4. Affine Projection
5. Uncalibrated Stereo
6. Structure from Motion
7. Robust Estimation in Computer Vision
8. Experiment and Discussion

2nd quarter

Course instructor: Assoc. Prof. Yasuyuki Sugaya

Aims:
This course will introduce camera calibration methods and AR applications with various markers, including a famous AR marker, a circular marker, and natural points and lines features. Students develop an AR application based on the studied knowledge and discuss the performance of it.

Content:
1. Introduction and camera projection
2. Fundamental of camera calibration
3. AR applications
4. Camera pose estimation by a rectangular marker
5. Camera pose estimation by a circular maker
6-1. Experiment and discussion
6-2. Camera pose estimation by 2-D textures
7. Camera pose estimation by lines
8. Experiment and discussion

Data Science and Analysis (4 ECTS) – Core Courses

1st quarter

Course instructor: Assoc. Prof. Tomoyoshi Akiba

Aims:
Important topics on statistical natural language processing will be discussed by focusing on statistical machine translation.

Content:
1. Introduction
2. Lecture (Basic of Probability and Statistics, Recent Trends in Machine Translation)
3. Presentation & Discussion (Statistical Method for Machine Translation)
4. Presentation & Discussion (Language Models)
5. Presentation & Discussion (Translation Models)
6. Presentation & Discussion (Parameter Estimation)
7. Presentation & Discussion (EM Algorithm)
8. Presentation & Discussion (Advanced methods in SMT)

2nd quarter

Course instructor: Prof. Shigeru Kuriyama

Aims:
This class teaches the design methodology of developing data exploration tools by efficiently and effectively visualizing huge size or dimension of dataset. Practical skill of developing the workflow of visual data analytics is learned through the exercises.

Content:
1. Introduction and overview of information visualization
2. Correlation visualization of multivariate data
3. Relation visualization with tree and network representation
4. Visualization of correlation using glyph
5. Visualization of textual information and time-variation, and interactions
6. Design of workflow
7. Presentation of exercise

Advanced Research Methods (4 ECTS) – Core Courses

Course instructor: Supervisors at TUT (literature review at lab)

Aims:
The course is intended for students to study basic materials in depth, related to his/her research topics through the lab works. It is also aimed for students to acquire various skills, required in general research work, such as those for literature review, oral presentation, and technical discussion and writing.

Content:
While specific contents depend on the research topics students are involved in, it is usually the case for students to read relevant textbooks/research papers and report on them, as well as to present and discuss on the research work of their own.

Case Study in Imaging and Light and XR (8 ECTS) – Core Courses

Course instructor: Supervisors at TUT (project work at lab)

Aims:
As a stepping stone to a Master's research, a preliminary project involving measurement experiments or system development is carried out under the supervision of a supervisor. After a necessary and sufficient survey of the relevant research, students define the research question, consider the appropriate research methods and discuss the impact of the results obtained. A presentation opportunity is given at the end of the semester to exchange the ideas among other students and supervisors. Master's research may be carried out by improving/expanding the project.

Content:

The project theme is initially presented as a candidate by the supervisors and is finally decided through discussion with the students.

Ethics for Researchers (2 ECTS) – Core Courses

Course instructor: e-learning

Aims:
Assist graduate students as they undertake research activities and promote an understanding of the inherent ethical problems; lead students to think independently and exercise normative consciousness of research ethics through ethics education in research in accordance with goals of scientific education and research and characteristics of individual research specialties.

Content:
1. Guidance Introduction
2-5. e-learning modules:
   - "Ethical Issues in the Management of Data in Engineering Research"
   - "Responsible Authorship"
   - "Ethical Issues in the Peer Review and Publication of Engineering Research"
   - "Collaborative Research in Engineering Fields"
   - "Whistleblowing and the Obligation to Protect the Public"
   - "Managing Public Research Funds"
6. Discussion with supervisor
7. Final report writing

Japanese Communication Theory- Japanese Language - (4 ECTS)

– Core Courses (non-Japanese students)

Course instructor: Chikako Ishikawa

Aims:

The purpose of this course is to learn new Japanese grammar/expression and how to use them to communicate with Japanese people in Japanese. After having successfully taken this course, the student can give a presentation in Japanese.

Content:

1. Introduction
2. Genki II Lesson 13-(1) Vocabulary & Grammar
3. Lesson 13-(2) Conversation
4. Lesson 14-(1) Vocabulary & Grammar
5. Lesson 14-(2) Conversation
6. Lesson 15-(1) Vocabulary & Grammar
7. Lesson 15-(2) Conversation
8. Exam (Presentation & Discussion)
9. Lesson 16-(1) Vocabulary & Grammar
10. Lesson 16-(2) Conversation
11. Lesson 17-(1) Vocabulary & Grammar
12. Lesson 17-(2) Conversation
13. Lesson 18 Grammar & Conversation
14. Lesson 19 Grammar & Conversation
15. Lesson 20 Grammar & Conversation
16. Final Exam (Presentation& Discussion)

Course material

GENKI Ⅱ: An Integrated Course in Elementary Japanese Vol.2 [Third Edition]
初級日本語げんきⅡ[**第** 3 **版**] (Japanese Edition), Japan Times, ISBN: 978-4-7890-1732-9

Amazon:
https://www.amazon.com/GENKI-Integrated-Course-Elementary-Japanese-ebook/dp/B08L5W9B88/ref=sr_1_7?dchild=1&keywords=genki&qid=1626082661&s=digital-text&sr=1-7

Amazon Japan:
https://www.amazon.co.jp/GENKI-Integrated-Elementary-Japanese-%E5%88%9D%E7%B4%9A%E6%97%A5%E6%9C%AC%E8%AA%9E%E3%81%92%E3%82%93%E3%81%8D/dp/478901732X/ref=sr_1_2?__mk_ja_JP=%E3%82%AB%E3%82%BF%E3%82%AB%E3%83%8A&crid=38TCUMJ8MH8ZZ&dchild=1&keywords=%E3%81%92%

Japanese Industrial Technologies and Innovations (4 ECTS) – Elective Courses

Course instructor: TBA

Aims:
In this series of lectures, the excellent experts of our university and Japanese leading companies from variety of fields in engineering impart to the engineering students' knowledges of superior industry technologies in Japan. Students learn advantages and its contribution factors of Japanese industrial technologies.

Content:
The course will be offered in an omnibus format. The lecturers and schedule will be announced at the beginning of the semester.