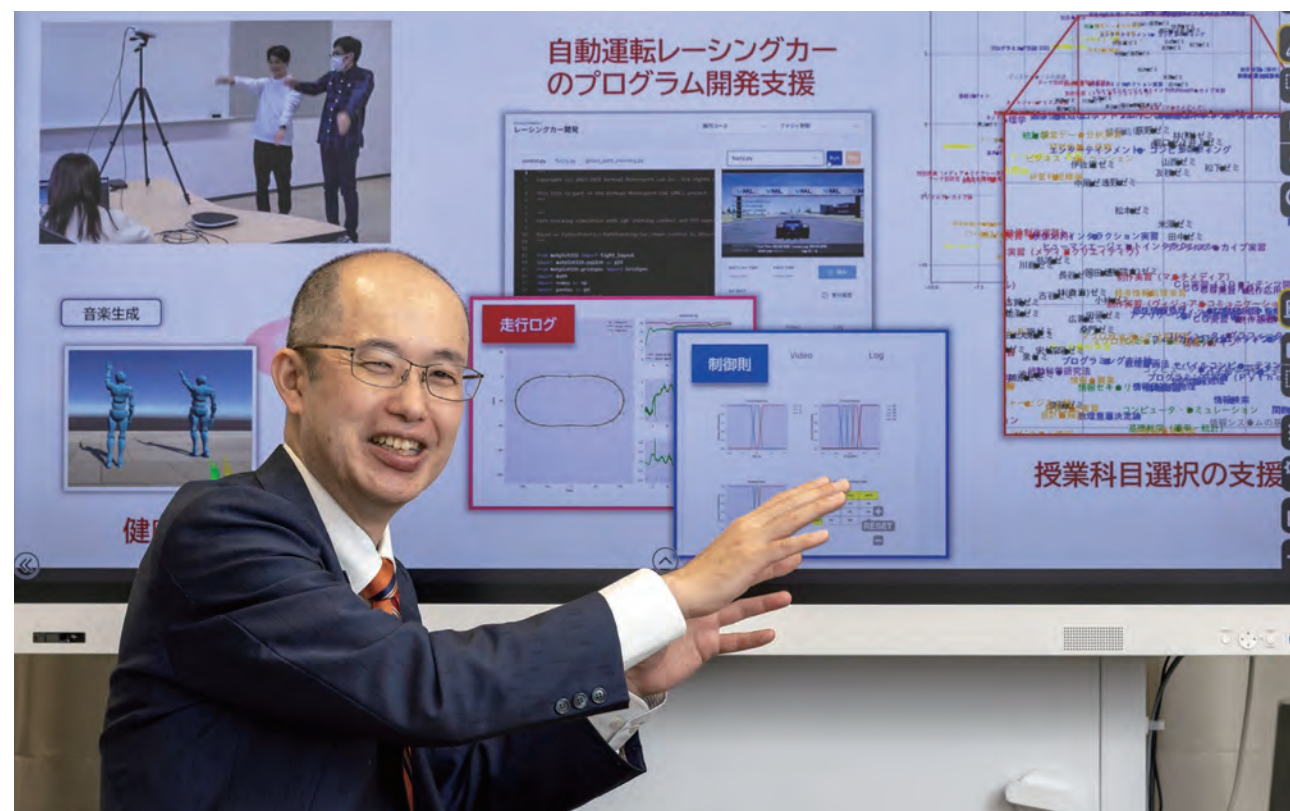


■研究最前線

認知工学で人の意思決定を助ける技術を研究 • Research on technology that assists human decision-making through cognitive engineering



万博に来る子どもたちに 技術開発の楽しさと学びを

自動運転レーシングカーの開発体験を提供

Helping children visiting the Expo experience the joy and learning of technology development

Providing experience in developing autonomous racing cars

大阪・関西万博の大阪ヘルスケアパビリオンでは、大阪が誇る中小・スタートアップ企業の技術を発信する展示企画「リボーンチャレンジ」が開催されている。8月5～11日には関西大学が実施主体となり、「Academia×REBORN ～学理と実際の調和～」と題して9つの企業の技術や未来社会に向けた取り組みを紹介する。その一つであるVML社(Virtual Motorsport Lab Inc.)の展示ブースでは、来場者がその場でパソコン上の自動運転シミュレータを操作して好みのレーシングカーをカスタマイズし、仮想空間のサーキットを走らせるという体験を提供。その仕掛けづくりに総合情報学部の堀口由貴男教授とゼミ生3人が協力している。8月の本番に向けて準備は佳境だ。

At the Osaka Healthcare Pavilion of the Osaka-Kansai Expo, an exhibition project called "Reborn Challenge" is being held to showcase the technologies of small and medium enterprises and startups that Osaka takes pride in. In August, Kansai University will serve as the implementing body, introducing the technologies and initiatives toward future society of nine companies under the theme "Academia × REBORN -Harmony between Academia & Society, between Theory & Practice-". At the exhibition booth of VML (Virtual Motorsport Lab Inc.), which is one of these companies, visitors can experience operating an autonomous driving simulator on a computer right there on the spot, customizing their preferred racing car, and running it on a virtual circuit. Professor Yukio Horiguchi from the Faculty of Informatics and three students are cooperating in creating this setup. Preparations are in full swing for the main event from August 5th to 11th.

●総合情報学部 堀口 由貴男 教授
Faculty of Informatics
— Professor Yukio Horiguchi

企業のさまざまな課題を解決するシステム工学

—先生の専門について教えてください。

現象や物事をさまざまな要素同士の関係性として捉え、数学的な理論や手法を応用して読み解き、より良い仕組みや方法を検討するのがシステム工学で、問題解決のための学問です。その中でも私は認知工学・知能情報学の専門家として、人の意思決定を助ける技術を研究しています。例えば、産業用ロボットのプログラミング熟練者の知識を他の人に活用してもらうために操作端末の情報表示のデザインを考えたり、デジタル家電のユーザーインターフェースの使いにくさの原因を調べて改善したり、列車運転士のスキル獲得支援のために運転台のデザインを見直すなど、企業のさまざまな課題に共同研究で取り組んできました。システム工学の手法で人の行動を分析し、その上で装置やサービスをより安全かつ効果的に利用できるようにするための情報デザインを研究しています。—今回万博に出展するVML社と共同研究に至った経緯を教えてください。

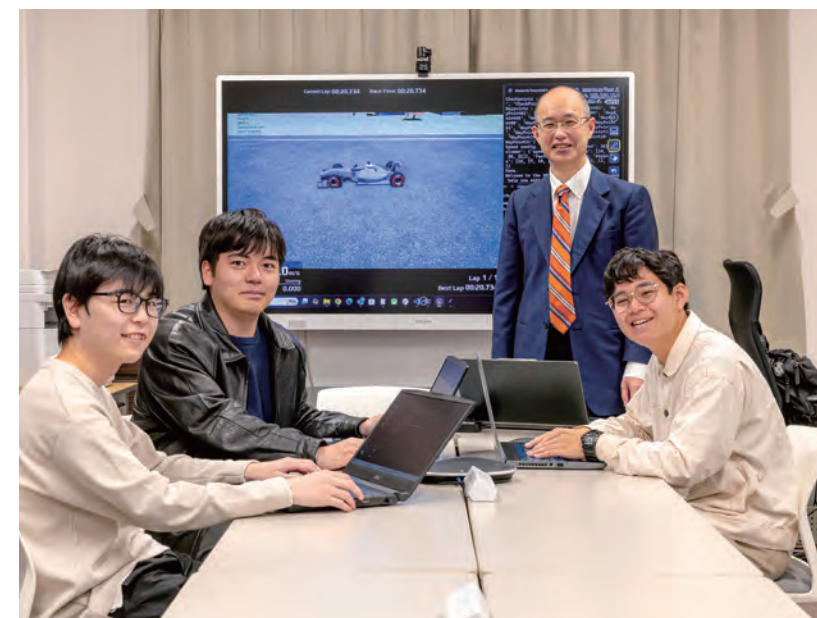
仮想空間での車の自動運転シミュレータを開発したVML社が2023年に関西大学のリボーンチャレンジに応募され、マッチングで私が連携相手選ばれました。2022年に会社を設立した同社の山下洋樹代表は、元々ヨーロッパのフォーミュラー・レースでデータ分析エンジニアをされていました。自動車業界にも今後さらにITやコンピュータに詳しい人材が必要になると考えて、「自動運転」をキーワードに、技術開発に携わる人材を育成したい、フォーミュラー・レースのような自動車の最先端技術を開発するためのテストの場を提供したい、と仰っていました。私はそのお考えに共感し、お手伝いすることにしました。

万博でのVML社の展示が先進的な自動運転技術への興味を喚起し、人々の交流の機会を増やすきっかけとなるよう、情報デザインの観点からアイデアを提供しています。交流や学びのプラットフォームとして、より豊かな体験を提供するためにはどうすればよいかを一緒に考えています。

—具体的な展示内容を教えてください。

最終的な目標は、来場者が生成系AI技術を活用しながら独自のレーシングカーを作れるようにすることです。コース取りや速度など、車の走り方もカスタマイズします。プログラミングは一般の人にとって少しハードルが高いので、言葉でAIアシスタントに命じることで自動的にプログラムができるという仕組みを活用します。ごく短時間で自分の車のプログラムが完成し、仮想サーキットを走らせることができます。

8月の本番に向けてゼミの4年次生3人と一緒に展示内容の開発を進めており、準備は佳境に入っています。原田隼さんは来場者(ユーザー)の行動を想定したシステム応答などの対話進行のデザイン、山田晴己さんはユーザーのマルチな要求に応えるためのAIプログラムの調整、吉俣颯人さんは2人のサポートに加え、VML社に協力いただいて日本知能情報ファジィ学会で実施している「VML自動運転ハッカソン」という自動運転プログラミング競技イベントのシステムのアップグレードを担当しています。



▲研究室でゼミ生の指導にあたる堀口教授
写真左から山田さん、吉俣さん、堀口教授、原田さん
Prof. Horiguchi supervising seminar students in his laboratory
Left to right: Yamada, Yoshimata, Prof. Horiguchi, and Harada

■ Systems engineering that solves various corporate challenges

— Please tell us about your specialty.

Systems engineering is the discipline of problem-solving that captures phenomena and things as relationships between various elements, utilize mathematical theories and methods to interpret them, and examines better mechanisms and methods. Within this field, I am a specialist in cognitive engineering and intelligent informatics, researching technology that assists human decision-making. For example, I have engaged in joint research on various corporate challenges, such as designing information displays for operation terminals so that the knowledge of experts in programming industrial robots can be utilized by others, investigating the causes of user interface difficulties in digital home appliances and making improvements, and reviewing the design of driver's cabs to support skill acquisition for train operators. I analyze human behavior using systems engineering methods, and then research how to design information so that people can use equipment and services more skillfully and safely.

— Please tell us about the background that led to the joint research with VML, which is exhibiting at the Expo this time.

VML, which developed an autonomous driving simulator for cars in virtual space, applied to Kansai University's Reborn Challenge in 2023, and I was selected as their collaboration partner through matching. Hiroki Yamashita, the representative of VML, which was established in 2022, was originally a data analysis engineer in Formula racing in Europe. He said that he believed the automotive industry would need more people knowledgeable in IT and computers in the future, and wanted to nurture human resources involved in technology development with autonomous driving as a keyword, and to provide a testing ground for developing cutting-edge automotive technologies like Formula racing. I sympathized with his ideas and decided to help.

I am providing ideas from an information design perspective so that VML's exhibition at the Expo will stimulate interest in advanced autonomous driving technology and serve as a catalyst for increasing opportunities for human interaction. We are thinking together about how to provide richer experiences as a platform for interaction and learning.

■研究最前線

■言葉とコンピュータを繋ぐファジィ理論

——ハッカソンと万博では何が違うのでしょうか。

万博は一般の方々を楽しませるのが目的ですが、ハッカソンは情報処理技術やAI技術を学び研究している学生たちを主な対象とし、自動運転レーシングカーのプログラミングを通じてその技術を高めてもらうことが目的です。私は日本ファジィ学会の事業委員を務めているのですが、学会での研究者や学生、企業との交流にVML社の取り組みがうまくはまるのではないかと思います、ハッカソンを企画しました。ハッカソンは昨年に続いて2025年も実施を計画しています。

——ファジィ理論とはどのような学問でしょうか。

コンピュータは基本的に計算で問題を解決しますが、私たちが日常使っている言葉とコンピュータが扱う数値は必ずしもきれいに対応しません。その間を取り持つのがファジィ理論です。例えば自動車の運転に関して「左に少しずれたら右にハンドルを少し切る」という言語化された知識はコンピュータで扱いづらいのですが、ファジィ理論はそれをうまく繋いでくれます。ハッカソンではレーシングカーの自動運転機能の一部にファジィ制御を組み込んで、より高度な走行制御に取り組めるように工夫を凝らしています。

■ゲームでなく学びの場に

——万博での展示の工夫について教えてください。

ブースへの来場者が「いかにスムーズに面白く自動運転のカスタマイズを体験できるか」を工夫しています。大きなモニター画面でコンシェルジュやサポーター役のAIと対話しながらコースの走り

自動運転レーシングカーの開発体験と使用ツール
Hands-on experience and tools for developing autonomous racing cars

Virtual Motorsport Lab 社の開発体験イベント

- モビリティ産業を支える才能育成の場作りが目的
- 参加者は独自の自動運転プログラムを開発しラップタイムを競う

Virtual Motorsport Lab's Hands-on Development Workshop

- The goal is to create a platform for nurturing talent to support the mobility industry.
- Participants develop their autonomous driving programs and compete for lap times.

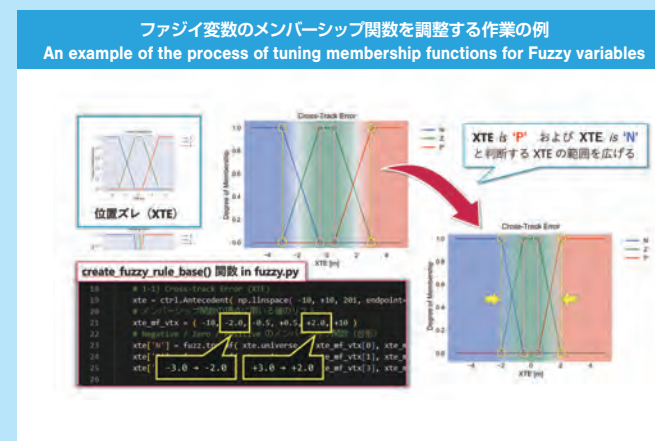
レーシングカー開発

コード編集
Code Editing

運転シミュレーション
Driving Simulation

設定の可視化
Visualization of Settings

走行ログ表示
Driving Log Visualization



▲堀口教授によるハッカソンについてのプレゼンテーション
Presentation by Prof. Horiguchi about the Hackathon

—— Please tell us about the specific exhibition content.

The ultimate goal is to enable visitors to create their own unique racing cars while utilizing generative AI technology. We also customize how the car runs, including course navigation and speed. Since programming has a somewhat high barrier for the general public, we utilize a mechanism where programs are automatically created by giving commands to an AI assistant in words. In a very short time, visitors can complete their car's program and run it on a virtual circuit.

We are developing the exhibition content together with three fourth-year students toward the August main event, and preparations are entering their final stage. Shun Harada is responsible for designing dialogue progression including system responses assuming visitor (user) behavior, Haruki Yamada is adjusting AI programs to respond to users' multiple demands, and Ryuto Yoshimata is supporting these two while also working on upgrading the system for the "VML Autonomous Driving Hackathon," an autonomous driving programming competition that we conduct at the Japan Society for Fuzzy Theory and Intelligent Informatics in cooperation with VML.

■ Fuzzy theory that connects words and computers

—— What is the difference between the hackathon and the Expo?

The Expo aims to entertain the general public, but the hackathon mainly targets students who are learning and researching information processing and AI technologies, with the purpose of improving their skills through programming autonomous racing cars. I serve as a business committee member of the Fuzzy Society, and I thought VML's initiatives would fit well with exchanges between researchers, students, and companies at academic conferences, so I planned the hackathon. We are planning to hold the hackathon again in 2025 following last year.

—— What kind of discipline is Fuzzy theory?

Computers basically solve problems through calculations, but the words we use in daily life and the numerical values that computers handle do not necessarily correspond neatly. Fuzzy theory serves as an intermediary between them. For example, verbalized knowledge about automobile driving like "if you drift slightly to the left, turn the steering wheel slightly to the right" is difficult for computers to handle, but Fuzzy theory connects this well. In the hackathon, we are attempting to incorporate Fuzzy control into part of the racing car's autonomous driving functions so that participants can work on more advanced driving adjustments.

■ A place for learning, not gaming

—— Please tell us about the innovations in the Expo exhibition.

We are working on "how visitors to the booth can experience autonomous driving customization as smoothly as possible in the most interesting way." Visitors will discuss topics such as course navigation and tire equipment combinations while having dialogue with AI acting as concierges and supporters on large monitor screens, and run their designed autonomous racing cars on the circuit. They can enjoy watching their cars run well, go off course, or see how their cars perform right there on the spot. We want as many people as possible to experience AI technology in a short time, and we are also working on how to show the programming process in an easy-to-understand way. We want this to be a place of learning for children, not just a game. I would be happy if children could develop interest in programming and AI through this experience, or dreams of pursuing this field.

—— Please share your expectations for the Osaka Expo.

It would be wonderful if we could get reactions like "That was fun!" or "That was interesting!" from visitors. I hope that as many children and young people as possible will become interested in the research fields of the Faculty of Informatics.

■ Research that supports human decision-making

—— Please tell us about your other research themes.

I said that systems engineering is a discipline of problem-solving, and I have students work on various research themes together with me. For example, my research themes include "data processing technology for analyzing elderly people's movements to evaluate fall risk and motor function levels," "exercise support that introduces gaming elements and mechanisms where music flows according to body movements to make health promotion enjoyable," "respiratory waveform analysis algorithms for automatic detection of sleep apnea," "improvement of medical interview systems through effective question selection for sleep disorders," and "comparative analysis of how people good and poor at English read English texts based on eye movement measurements, and learning support." Among student-initiated research, there are unique themes such as "syllabus data analysis and information visualization to support decision-making in seminar selection." What they have in common is information processing that supports human decision-making. There is no end to themes related to people.