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Three Papers from Mitsubishi Electric's Researchers Accepted to NeurIPS2024
Recognized for the companies' research results at the top conference
in the fields of AI and machine learning

TOKYO, December 3, 2024 – Mitsubishi Electric Corporation (TOKYO:6503) announced today that three papers submitted by researchers at its Information Technology R&D Center (Kamakura City, Kanagawa Prefecture) and at Mitsubishi Electric Research Laboratories, Inc. (MERL), a subsidiary located in the United States (Cambridge, Massachusetts), have been accepted to the Conference on Neural Information Processing Systems (NeurIPS) 2024. In addition, MERL is leading the organization of a workshop at the conference.

NeurIPS is the premier conference in the field of AI and machine learning. In 2024, about 25% of papers were accepted from more than 15,000 submissions. Details of the accepted papers and the workshop are provided below. The papers will be presented during the conference sessions in Vancouver, Canada from December 10 to 15. Mitsubishi Electric will continue to work on research and development of cutting-edge technologies with the aim of contributing to a sustainable future.

List of Accepted Papers

-Title
RETR: Multi-View Radar Detection Transformer for Indoor Perception
-Authors
Ryoma Yataka (Mitsubishi Electric), Adriano Cardace (Bologna University), Pu (Perry) Wang (MERL), Petros Boufounos (MERL), Ryuhei Takahashi (Mitsubishi Electric)
-Abstract
Radar-based indoor perception[1] has been gaining increased attention in indoor monitoring and surveillance due to its ability to protect privacy and its high reliability in dangerous situations like fires. However, achieving high-precision predictions has been difficult because of low resolution. In this paper, we propose the Radar Detection Transformer (RETR)[2] to enhance the accuracy of radar perception. RETR is based on

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[1] Radar-Based Indoor Perception: A technology that detects and recognizes the surrounding environment and objects using radar. Since radar can measure the position, speed, and shape of objects using radio waves, it offers high reliability even in poor visibility conditions or darkness.

[2] Radar Detection Transformer (RETR): A deep learning model for object detection using radar data.

the recent object detection technology called Detection Transformer (DETR). By incorporating feature correlations for integrating multiple radars and embedding learning with prior knowledge of coordinate transformations between radar and camera, RETR has demonstrated state-of-the-art accuracy that significantly surpasses previous methods.

-URL

[NeurIPS Paper - RETR: Multi-View Radar Detection Transformer for Indoor Perception (neurips.cc)](neurips.cc)

-Title

Learning to compute Gröbner bases

-Authors

Hiroshi Kera (Chiba University), Yuki Ishihara (Nihon University), Yuta Kambe (Mitsubishi Electric), Tristan Vaccon (University of Limoges), Kazuhiro Yokoyama (Rikkyo University)

-Abstract

In recent years, there have been reports of faster mathematical problem solving by training machine learning models. In this paper, we construct the world's first[3] end-to-end model of Gröbner basis[4] computation, which has various applications. We have discovered examples where our model computes solutions faster than existing methods.

-URL

[NeurIPS Paper - Learning to compute Gröbner bases (neurips.cc)](neurips.cc)

-Title

Evaluating Large Vision-and-Language Models on Children's Mathematical Olympiads

-Authors

Anoop Cherian (MERL), Kuan-Chuan Peng (MERL), Suhas Lohit (MERL), Joanna Matthiesen (Math Kangaroo USA), Kevin Smith (Massachusetts Institute of Technology), Joshua B. Tenenbaum (Massachusetts Institute of Technology)

-Abstract

Recent years have seen significant progress in the general-purpose problem-solving abilities of large vision and language models (LVLMs[5]). However, a systematic analysis of AI capabilities for joint vision and text reasoning is missing in the current scientific literature. The paper evaluates LVLMs using Mathematical Kangaroo Olympiad problems, which test students' analytical and critical thinking skills through age-appropriate puzzles. The result shows LVLMs excel in higher-grade problems but struggle with younger children's problems, highlighting the differences between LVLMs reasoning abilities and limitations against human cognition, such as AI models performing below children's average across all grades.

-URL

[NeurIPS Paper - Evaluating Large Vision-and-Language Models on Children's Mathematical Olympiads (neurips.cc)](neurips.cc)

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[3] According to Mitsubishi Electric's research as of December 3, 2024.

[4] A specific system of polynomials which is possible to analyze the algebraic structure of a given polynomial system.

[5] Generative AI models that integrate and comprehend both visual information, such as images and videos, and language information to perform a variety of tasks.

MERL Co-organized Workshop

-Title Multimodal Algorithmic Reasoning (MAR) Workshop -Organizers Anoop Cherian (MERL), Kuan-Chuan Peng (MERL), Suhas Lohit (MERL), Honglu Zhou (Salesforce AI Research), Kevin Smith (Massachusetts Institute of Technology), Tim K. Marks (MERL), Juan Carlos Niebles (Salesforce AI Research), Petar Veličković (Google DeepMind)
-Abstract This workshop aims to bring together researchers working in neural algorithmic learning[6], multimodal reasoning[7], and cognitive models of intelligence to showcase their cutting-edge research and discuss the latest challenges. The workshop takes a deep dive into this exciting topic towards understanding what we have achieved thus far in machine intelligence and what we are lacking in relation to the human way of thinking, through talks from outstanding researchers and faculty. -URL NeurIPS Workshop - Multimodal Algorithmic Reasoning (MAR)

Reference: List of Accepted Papers at Workshops

-Title Probabilistic Forecasting for Building Energy Systems: Are Time-Series Foundation Models The Answer? -Authors Young-Jin Park (Massachusetts Institute of Technology), Jing Liu (MERL), François G Germain (MERL), Ye Wang (MERL), Toshiaki Koike-Akino (MERL), Gordon Wichern (MERL), Navid Azizan (Massachusetts Institute of Technology), Christopher R. Laughman (MERL), Ankush Chakrabarty (MERL)
-Title Forget to Flourish: Leveraging Model-Unlearning on Pretrained Language Models for Privacy Leakage -Authors Md Rafi Ur Rashid (Penn State University), Jing Liu (MERL), Toshiaki Koike-Akino (MERL), Shagufta Mehnaz (Penn State University), Ye Wang (MERL)
-Title Spatially-Aware Losses for Enhanced Neural Acoustic Fields -Authors Christopher Ick (New York University), Gordon Wichern (MERL), Yoshiki Masuyama (MERL), François G Germain (MERL), Jonathan Le Roux (MERL)
-Title FV-NeRV: Neural Compression for Free Viewpoint Videos -Authors Sorachi Kato (Osaka University), Takuya Fujihashi (Osaka University), Toshiaki Koike-Akino (MERL), Takashi Watanabe (Osaka University)

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[6] A method or procedure that uses neural networks to generate algorithms or procedures that can learn and perform specific tasks.

[7] A method for integrating different modalities of data (such as visual and text inputs) to perform reasoning.

-Title GPT Sonography: Hand Gesture Decoding from Forearm Ultrasound Images via VLM -Authors Keshav Bimbraw (Worcester Polytechnic Institute), Ye Wang (MERL), Jing Liu (MERL), Toshiaki Koike-Akino (MERL)
-Title Smoothed Embeddings for Robust Language Models -Authors Ryo Hase (Mitsubishi Electric), Md Rafi Ur Rashid (Penn State University), Ashley Lewis (The Ohio State University), Jing Liu (MERL), Toshiaki Koike-Akino (MERL), Kieran Parsons (MERL), Ye Wang (MERL)
-Title Slaying the HyDRA: Parameter-Efficient Hyper Networks with Low-Displacement Rank Adaptation -Authors Xiangyu Chen (University of Kansas), Ye Wang (MERL), Matthew Brand (MERL), Pu (Perry) Wang (MERL), Jing Liu (MERL), Toshiaki Koike-Akino (MERL)
-Title Preference-based Multi-Objective Bayesian Optimization with Gradients -Authors Joshua Hang Sai Ip (University of California Berkeley), Ankush Chakrabarty (MERL), Ali Mesbah (University of California Berkeley), Diego Romeres (MERL)
-Title TR-BEACON: Shedding Light on Efficient Behavior Discovery in High-Dimensions with Trust-Region-based Bayesian Novelty Search -Authors Wei-Ting Tang (The Ohio State University), Ankush Chakrabarty (MERL), Joel A. Paulson (The Ohio State University)

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