ICONI

KSII **KOREAN SOCIETY FOR INTERNET INFORMATION**

The 15th International Conference on Internet

(ICONI 2023)

Dec. 17-20, 2023, Lotte Hotel Saigon, Hochiminh, Vietnam

http://www.iconi.org

Conference Program

| Organized by |

Korean Society for Internet Information (KSII)

| Co-Organized by |

Advanced Institute of Convergence Technology(AICT)

Contents

Message from Honorary Chair

Dr. Kwanghoon Pio Kim

Kyonggi Univ.,

Rep. of Korea

We express our warm welcome to all of attendants of the 15th International Conference on Internet (ICONI) that will be held from December 17~20, 2023, in Lotte Hotel Saigon, Hochiminh, Vietnam.
Over the past 15 years, ICONI has increased its academic impact and influence in the area of Information Science, Computer Engineering and Internet Technology by bringing together international researchers from academia, industry, and the government to exchange novel ideas, explore enabling technologies, discuss innovative designs, and share field trial experiences and lessons learned.

This year, ICONI 2023 again covers a broad range of topics which are related with Internet technologies and applications such as wireless and sensor networks, security & privacy, multimedia, image processing, intelligent systems, mobile computing, Internet of things, and wireless communications.
It is firmly believed that each paper to be presented will be a basis for further constructive discussion.

We would like to express our heartfelt gratitude to every one who makes this conference successful. First of all, we are so grateful to all contributors who submit their valuable papers, review the papers, and chair the sessions. We also thank many sponsors for their enormous support. Our special thanks must go to the Keynote Speakers Mr. Vo Ngoc Han, Prof. Pham The Bao and Dr. Ton Long Phuoc.

Last but not least, we deeply appreciate limitless devotion of the Organizing Committee members. Without their contribution, this conference would not be realized.

We truly welcome you all to this beautiful country and wish you pleasant and joyous stay in Hochiminh, Vietnam!

Dr. Kwanghoon Pio Kim

Honorary Chair of ICONI 2023

Message from Conference Chair

Dr. Ihnhan Bae
Daegu Catholic Univ.,
Rep. of Korea

On behalf of the organizing committee of the 15th International Conference on Internet (ICONI) 2023, I cordially welcome you and sincerely thank you for participating in this international conference to present and discuss valuable state-of-the-art research and development results.

We have been able to successfully plan for ICONI 2023, prioritizing all safety measures. More than 115 papers have been submitted in 17 Internet-related fields, including mobile Internet computing, Internet security, Internet of Things (IoT), wireless and sensor networks and multimedia, image processing and Internet application management. Among these papers, 115 papers will be presented during the conference.

In addition, there are 3 prominent world-famous Keynote Speakers that will be presenting during the ICONI 2023 conference, which include Mr. Vo Ngoc Han, CEO of Vietnam-Korean Trade Investment Consultancy and Prof. Pham The Bao, Dean in Department of Computer Science from Saigon University, and Dr. Ton Long Phuoc, Faculty of Information Technology from Industrial University of Hochiminh.

I owe a great amount of gratitude to the organizing committee members and all contributors for the extraordinary work they have done in organizing this conference. Without their dedicated support, this event would not be possible.

I wish you all a very pleasant time here in Hochiminh, Vietnam and a productive and successful conference.

Dr. Ihnhan Bae

Conference Chair of ICONI 2023

Message from Program Chairs

It is a pleasure to welcome you to the 15th International Conference on the Internet (ICONI 2023). ICONI 2023 will be held in Hochiminh, Vietnam, from Dec 17-20. The hosting organization (KSII) is one of the largest ICT-related academic societies in South Korea.

Over the past 15 years, ICONI has grown to be a major international conference in the Internet Technology area. The conference is organized into 17 tracks in the Internet Technology field. ICONI continues the endeavor of high-quality, broad international participation in all areas of Internet Technology.

The successful organization of ICONI has required the talents, dedication, and time of many volunteers from Malaysia, USA, Vietnam, China, Nepal and Republic of Korea. Special gratitude and appreciation go to all organizing committee members as they are primarily responsible for the conference. This ICONI conference serves as a unique and exciting gathering at the forefront of the most innovative and captivating realms of computer science. Your presence here provides a valuable opportunity to share novel ideas, research findings, and, importantly, to learn from each other's experiences, fostering mutual growth. I look forward to engaging in deep discussions, sharing fresh ideas, and fostering connections that will lead to newfound perspectives.

We hope that you will find the conference both enjoyable and valuable and also enjoy the architectural, cultural, and natural beauty of Hochiminh, Vietnam. I express my sincere gratitude to all participants for your tremendous support, and I genuinely hope that ICONI 2023 becomes a meaningful and enriching experience for each one of you. Thank you.

Dr. Junho Ahn
Kyonggi Univ.,
Rep. of Korea

Dr. Imran Ghani
Virginia Military Institute, USA

Dr. Junho Ahn, Dr. Imran Ghani
Program Chairs of ICONI 2023

Keynote Speakers

Keynote Speaker Mr. Vo Ngoc Han

Chairman & CEO – VKTIC (Vietnam-Korean Trade Investment Consultancy)

Vice chairman – VINK (Vietnam Innovation Network in Korea)

Vice chairman – TDX YBA

(Technology Digital Exchange – Young Business Associates)

Title: The innovative technology creates a better life: Case studies in Vietnam

Abstract of the talk

Artificial intelligence (AI) and modern technology are making life more convenient and helping businesses thrive as a new revolution that creates more opportunities for people. Despite commencing from a position behind long-established companies, fledgling startups can attain remarkable advantages and contribute significantly to society and citizens. Most current business strategies are built by leveraging advanced data analysis methodologies and intelligent algorithms. At the same time, it also provides warnings, analysis, and measurements to minimize risks that may occur in the future. Besides, business ethics are currently being discussed in many ways around creating policies that establish strict regulations in using artificial intelligence. This presentation discusses these concerns and some case studies in the Vietnamese market.

Keynote Speaker Prof. Pham The Bao

Dean and Professor in Department of Computer Science, Information Science Faculty, Sai Gon University, Vietnam

Title: Quantum Computing and its Impact on AI in The Near Future

Keynote Speakers

Abstract of the talk

This presentation explores the growing intersection between Quantum Computing and Artificial Intelligence (AI), two of the most dynamic and promising fields in modern technology. Quantum computing, using the principles of quantum mechanics, offers unprecedented computing capabilities that surpass the limits of classical computing. This presentation briefly examines how the features of quantum computing have the potential to revolutionize AI. The focus is on how quantum computing can solve current challenges in AI, such as computational limitations, processing complex data sets, and optimizing machine learning algorithms. Furthermore, the presentation covers the current challenges and limitations in integrating quantum computing with AI. As well as showing potential in the near future, it could open up new frontiers in data processing, problem solving and predictive analytics.

Keynote Speaker Dr. Ton Long Phuoc

Faculty of Information Technology, Industrial University of Hochiminh, Vietnam

Title: IoT Technologies and Advanced Analytics as the Enablers for Digital transformation in Oil and Gas Industry.

Abstract of the talk

IoT plays a pivotal role across various industries, including manufacturing and services. The ongoing trend of digital transformation is witnessing rapid growth and widespread application in diverse fields, fostering the continual development of IoT technologies. Among the sectors embracing this digital evolution is the oil and gas industry, where numerous technological advancements, including IoT and AI, are being applied to streamline operations. This presentation will delve into the challenges encountered when implementing these cutting-edge technologies in the oil and gas exploration sector. Simultaneously, it will propose strategic directions for leveraging IoT devices to facilitate intelligent solutions. Additionally, the presentation will explore the integration of data analysis with AI to enhance decision-making processes within enterprise production activities.

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Yongjoon Lee, Far East University, ROK
Ogan Gurel, L'Institut des Sciences et Arts, Canada
Sudan Prasad Uprety, AICC Solution Lab, Nepal

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Pedestrian Collision Risk Assessment Based on Pedestrian's Motion Prediction for Autonomous Vehicles

Sunghwan Kim[1], Jaeseung Kim[1], Yeongwon Yu[1], Made Sudarma[2], Deden Witarsyah Jacob[3], and Minho Jo[1]

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Bali, Indonesia
3. School of Industrial and Systems Engineering, Telkom University,
Jawa Barat, Indonesia
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Abstract

Pedestrian collision avoidance is one of the key points for safe autonomous driving. In order to prevent pedestrian collisions in complex urban areas, it is important to consider the risk of different pedestrian types. Different targets of pedestrians, children, the disabled, and personal ride carriers such as bikes, and motor kickboards, have different risk levels. This paper proposes a pedestrian collision risk assessment algorithm based on motion prediction of different targets of pedestrians. We prioritize collision risk depending on different targets of pedestrians by predicting time-to-collision (TTC) with an autonomous vehicle. The experimental results show that the proposed risk priority algorithm proves effectiveness.

Keywords: Autonomous Driving, Collision Risk Assessment, Deep Learning, Motion Prediction, Time-to-Collision, Pedestrian Behavior Analysis

1. Introduction

In the evolving environment of autonomous vehicles (AVs), ensuring pedestrian safety remains a critical challenge. In complex urban areas, different targets of pedestrians, for example, children, the disabled, and personal ride carriers such as bikes, and motor kickboards, have different risk levels. Existing methods do not distinguish between various pedestrian targets. We consider different risk levels depending on speed of pedestrian targets in Table 1 [1][2]. The collision risk is not low even if objects are far away from a car, because motor kickboards and bikes have a higher risk of collision depending on their speed. Disabled people have a higher risk of collision than other pedestrians in the same location due to their slower reaction time. This paper proposes a multi-pedestrian collision risk assessment algorithm based on motion prediction of different targets of pedestrians. We prioritize collision risk

This research was supported in part by "Regional Innovation Strategy (RIS)" through the National Research Foundation of Korea (NRF) funded by the Ministry of Education (MOE)(2021RIS-004), in part by the National Research Foundation of the Korean Government under Grant NRF-2022R1A2C1010197.

depending on different targets of pedestrian by predicting time-to-collision (TTC) by an autonomous vehicle.

Pedestrian Targets	Speed (km/h)
Adults	5
Children	3
The disabled (Wheelchair)	10
Bikes	15
Motor Kickboards	20

Table 1. Speed of pedestrian targets

2. Proposed Methodology

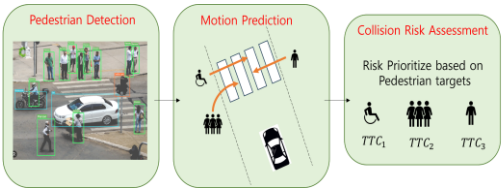

Fig. 1. Architecture of the proposed pedestrian collision risk assessment model

2.1 Pedestrian Detection

This research employs CityPersons dataset of urban traffic scenarios including various pedestrian densities and backgrounds [3]. YOLOv7, a state-of-the-art object detection model, was used for detecting pedestrians due to high accuracy and real-time processing capabilities [4]. We utilize a pre-trained YOLOv7 model and fine-tuned it with our target pedestrians including adults, children, people in wheelchairs, bikes, and motor kickboards.

2.2 Pedestrian Motion Prediction

Deep SORT is an advanced algorithm for object tracking, particularly effective in handling scenarios with moving cameras or multiple moving objects, like pedestrians in urban environments [5]. Pedestrians are tracked with Kalman Filter for predicting the future state (e.g., position and velocity) of pedestrians based on their past states. Deep SORT employs the Hungarian algorithm for data association, which solves the problem of matching detected objects with existing tracks.

2.3 Collision Risk Assessment

Targets of pedestrian have different risk levels depending on their speed and reaction time. A motor kickboard that is farther away from an AV has a higher level of risk than an adult that is nearby because the reaction time of motor kickboard is slow due to braking distance depending on the speed. Likewise, unexpected situations can occur in children or people in wheelchairs because they have poor attention and slow reaction time. Therefore, we propose a method using risk priorities according to the speed and reaction time of pedestrians to prevent accidents. The proposed risk priorities are as follow:

The disabled = Children > Motor Kickboard = Bike > Adults.

The future trajectory of an AV is denoted as y and pedestrians as z_i with T steps, where $i \in [1, \dots, N]$ is the number of pedestrians and T is a timestep in seconds. We first calculate the closest distance between the AV and pedestrians to determine if they have possibility to be in collision:

$$D_i = min_{t=1}^{T} \| y^t - {z_i}^t \|_2. \quad (1)$$

D_i compares the distance between pedestrians and the AV present in a situation. If $D_i > \varepsilon$, where ε is a threshold of safe distance between two objects, the AV and the pedestrian do not interfere with each other. Otherwise, we calculate the time steps between the AV and pedestrians when a collision occurs:

$$C_i = argmin_{t=1}^{T} \| y^t - {z_i}^t \|_2. \quad (2)$$

C_i defines the time step whenever each pedestrian meets with the AV. The pedestrian with smallest C_i meets the AV earliest while the largest C_i does the AV last.

When there are pedestrians with the same C_i value, the AV responds differently according to risk priority level. If a person in a wheelchair and an adult have the same C_i value, then the AV should reduce the speed for the disabled much faster than the adult, due to the disabled person's slower responds.

3. Experimental Results

The speed of an AV and pedestrians are assumed to be constant. The speed of the AV is

50 km/h, and the fixed speeds of the pedestrians are shown in Table 1. The AV at 50km/h needs a braking distance of 16m and takes 2 seconds to stop [6]. The experiment was conducted assuming that a collision will occur if the AV cannot stop within 2 seconds after detecting pedestrians and predicting the motion. When the risk priority algorithm is implemented, experimental results showed that the AV starts braking 2 seconds in advance for disabled people and children, and 1 second in advance for motor kickboards and bikes.

Targets of Pedestrian	Collision Rate	
	Without Risk Priority	With Risk Priority
Adults	25%	25%
Children	30%	22%
The disabled (Wheelchair)	23%	14%
Bikes	23%	17%
Motor Kickboards	35%	28%

Table 2. Comparison of collision rates with the proposed risk priority algorithm

Table 2 shows comparison of collision rates with proposed risk priority algorithm. Adults are not considered a priority, there was no effect on the collision rates in the experimental results. However, children, disabled people, bikes, and motor kickboards that take risk priority have the effect of reducing the collision rates by an average of 7%. The results prove that our proposed risk priority algorithm based on targets of pedestrian is effective.

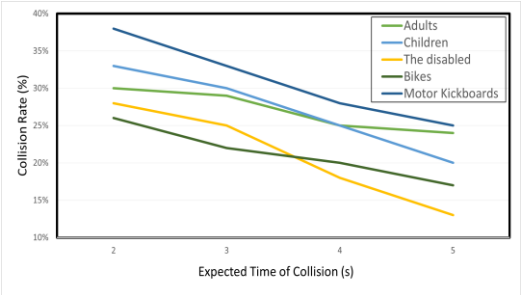

Fig. 2. Comparison of collision rates according to expected time of collision

Figure 2 shows the collision rates when each pedestrian target has the same collision time. The results show that as the expected time of collision is given sufficiently, the AV is able to brake to prevent a collision. Moreover, it shows that children, disabled people, bikes, and motor kickboards with risk priority tended to see a greater reduction in collision rates compared to adults without risk priority.

4. Conclusion

This paper proposed a pedestrian collision risk assessment algorithm that considers various targets of pedestrian, including children, the disabled, bikes, and motor kickboards. The proposed algorithm predicts the time-to-collision (TTC) with different pedestrian targets, allowing AV to brake in time for avoiding collisions. This advancement makes a significant step towards improving the interaction between autonomous vehicles and pedestrians, ensuring safety in urban traffic environments. For the future work, we plan to implement the proposed risk priority algorithm in a real vehicle on the road and to check if it works properly in the road test.

References

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Pedestrian Collision Risk Assessment Based on Pedestrian's Motion Prediction for Autonomous Vehicles

by Made Sudarma

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Pedestrian Collision Risk Assessment Based on Pedestrian's Motion Prediction for Autonomous Vehicles

Sunghwan Kim[1], Jaeseung Kim[1], Yeongwon Yu[1], Ir. Made Sudarma[2], Deden Witarsyah Jacob[3], and Minho Jo[1]

1. Department of Computer Convergence Software, Korea University Sejong, South Korea

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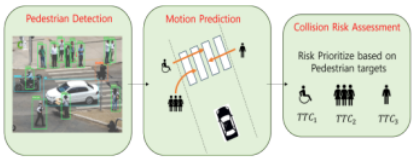

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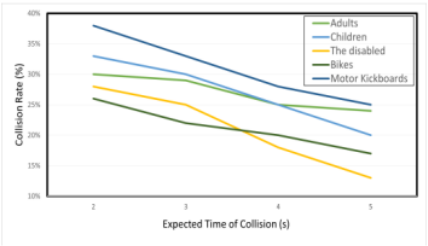

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