FDS
數據科學學院
Faculty of Data Science

澳門城市大學
Universidade da Cidade de Macau
City University of Macau

年度報告

Annual Report

2022

數據科學學院
Faculty of Data Science

Welcome Message

Looking back on 2022, the world continued to confront challenges and transformations in the post-pandemic era, with the field of data science emerging as a core force driving innovation and solving complex problems. During this pivotal year, our college achieved growth in both teaching and research through the collective efforts of all faculty and students. We also deepened industry-academic collaboration and social contributions, demonstrating the value of data science across diverse domains. In teaching, we actively expanded online cooperation with leading international institutions, ensuring our students stay abreast of ever-changing technological trends.

Looking ahead, we will continue to focus on three key pillars: "Data Science," "Artificial Intelligence," and "Information Security," striving to deepen the balance between ethical deliberation and technological application. We look forward to joining hands with partners from all sectors to cultivate a new generation of data leaders who possess both professional expertise and humanistic literacy, using science to address the defining questions of our time.

This report serves to document our shared dedication and achievements. We extend our gratitude to every contributor in the college for their wisdom and passion. May the light of data continue to illuminate our path as we co-create a more resilient future.

Contents

Brief overview of the Faculty of Data Science

We have been growing rapidly in the last few years. At the end of 2022, the Faculty of Data Science had 598 students, 7 full-time academics and 2 Administrative Staff.

Snapshot of FDS staff and student numbers at the end of 2022

Student numbers and levels. As shown in Table 1, FDS has 598 students in all levels at the end of 2022.

Table 1. Student numbers

FDS Program Overview						
Program Name	**Student Number**					
	Year 1	**Year 2**	**Year 3**	**Year 4**	**Deferral**	**Total**
Bachelor of Intelligent Technology and Services	183	157	57			397
Master of Data Science	77	40			5	122
Doctor of Data Science	40	20	17		2	79
Total Student Number	300	217	74		7	598

Where 13.21% are PhD students, 20.4% are master students and 66.39% are undergraduate students, respectively, as shown in Table 2.

Table 2. Student levels

Ph.D.	**Masters**	**Bachelors**	**Total**
79	122	397	598
13.21%	20.40%	66.39%	100%

Academic and professional staff numbers. At the end of 2022, FDS has 7 full-time academic staff and 2 administrative staff. Among the 7 full-time academic staff, there are 3 full professors and 4 assistant professors. In 2023, 6 academic staff will join the School of Data Science, bringing the number of full-time academic staff to 13.

Snapshot of FDS publication numbers at the end of 2022

As shown in Table 3, FDS published a total of 80 papers in 2022. Among the 80 papers, 62 were included in SCI, of which 41 were included in JCR Q1. Table 3 also shows the publication situation in 2022.

Table 3. Publication numbers in 2022

	Q1	Q2- Q4	EI	Monograph	CSSCI Core Journal	General Journal	ESCI	SCI Indexed	Total
2022	41	21	14	1	1	0	2	62	80

Teaching and learning

In 2022, we will make improving teaching quality a core task and carry out systematic optimization of existing degree courses. Among them, the three major courses of Bachelor of Science in Intelligent Technology and Services, Master of Science in Data Science and Doctor of Science in Data Science have officially started the certification process of the Ministry of Education's Education Quality Assessment Agency. This work focuses on key indicators such as curriculum design, faculty structure, learning resources and graduate competitiveness. Through a rigorous external review mechanism, we ensure that the course content is in line with industry trends and international academic standards, laying a foundation for high-quality education for students.

New programs and re-accreditation of existing programs in 2023

At the end of 2022, FDS had the following 3 programs:

- Bachelor of Intelligent Technology and Services, with an annual quota of 200.
- Master of Data Science, with an annual quota of 80.
- PhD in Data Science, with an annual quota of 40.

In the 2023 academic year, in response to the demand for digital transformation talents, the college plans to add three new courses and a joint course with Minzu University of China in Hainan.

- Bachelor of Computer Science, 60 places per year.
- Master of Computer Science, 80 places per year.
- Doctor of Computer Science, 40 places per year.
- Bachelor of Science in Data Science and Big Data Technology (co-organized with Minzu University of China), with 120 places per year.

The above measures highlight the college's dual-track strategy of "promoting excellence through certification and expanding the territory through innovation". The course certification process is expected to be completed in 2024, and the results report will be announced at the same time; the new courses have entered the filing stage of the Ministry of Education, and the first batch of enrollment for the new courses will start in 2023. The college will continue to strengthen the ability to connect industry and academia through curriculum innovation and strategic alliances, and cultivate data science elites with a global perspective.

Student organization activities, achievements, and awards

In 2023, students from the Faculty of Data Science actively participated in various activities and competitions and achieved good results. The Faculty also organized experts to conduct various lectures, which broadened the students' horizons and promoted the diversity of the discipline. Table 4 lists the lectures and activities organized in 2022, and Table 5 lists the various competitions that students participated in and the awards they won.

Table 4. Student organization activities

Activities Name	Date	No. of participants	Participants Group
Dealing with Advanced Persistent Threats: Case Studies	2022/04/20	200	All students of the faculty
Privacy preserving data sharing against malicious attacks	2022/05/04	60	2021 Master's students, 2021 Doctoral students
Enterprise digital transformation trends and practical paths	2022/11/03	40	2021 Master's students, 2021 Doctoral students

Table 5. Student achievements and awards

Competition Name	**Date**	**Awards**	**Awardees**	**No. of Awardees**
Huawei's 6th Global ICT (Information and Communications Technology) Competition	2022/3	Third Prize in Network Track	Jin Yuxin、Ma Chenxiao and Liu Yunzhi	**3**
Guangdong-Hong Kong-Macao Greater Bay Area IT Application System Development Competition	2022/9/16	Winner	Wang Jiaxu、Yang Ruochen、Zheng Guangyuan、Zhou Zhejun	**4**
Guangdong-Hong Kong-Macao Greater Bay Area IT Application System Development Competition	2022/9/16	Winner	Kang Jiajing、Wang Yaokang、Li Yaxuan	**3**
2022 Macau Cyber Security Technology Competition	2022/9/18	University Category Silver Award	Xiong Jingxiang、Ni Ertai、Pan Zuoqun、Zhou Qihe	**4**
2022 Macau Cyber Security Technology Competition	2022/9/18	Open Category Merit Award	Jin Yuxin、Ma Chenxiao、Kong Yitong、Xiang Yuwen	**4**
2022 China University Computer Competition-Network Technology Challenge	2022/9	National First Prize	Kong Lingyan、Hu Jinghao	**2**
"China Optics Valley. Huawei Cup" The 19th China Graduate Mathematical Modeling Competition	2022/10	National First Prize	Luo Haiyou	**1**
			Total number of awards	**7**
			Total number of awards	**21**

Alumni

Master of Data Science Program

Since the establishment of the Data Science Master's program, 79 graduates have successfully completed their studies at our university. According to the graduate survey report, most graduates are male (77.2%), while females constitute a smaller proportion (22.8%). The graduates are primarily from Mainland China (96.2%), with the remainder from Macao (3.8%, totaling 3 individuals). Most graduates hold an optimistic attitude toward their post-graduation prospects (44.3%), while a significant portion are relatively optimistic (41.8%). A small minority expressed no opinion (7.6%), and another small portion feel uncertain (6.3%). Currently, most graduates are employed (59.5%), while a minority have chosen to pursue further studies (40.5%).

Employment:

Among the employed graduates (59.5%), most are engaged in data science-related jobs (42.6%), while others have pursued careers in network engineering and security (12.8%) as well as software development (12.8%), and other fields (31.8%). Most of these graduate's work in Mainland China (87.2%), with the rest working in Macao (12.8%). The primary factors influencing their choice of current job are salary and benefits (34.0%), followed by the industry's popularity (23.4%) and relevance to their field of study (23.4%). Other factors include family considerations (12.8%) and personal interest (6.4%). Their future career plans mainly involve continuing to work at the same company (87.2%), followed by planning to join other companies within the data science-related industry (6.4%), with a small minority planning a career change (6.4%).

Further Studies:

Among the graduates who chose to pursue further studies (40.5%), the vast majority are pursuing doctoral degrees (90.6%), while the remainder are pursuing other professional programs or second master's degrees (9.4%). In terms of their field choice, an overwhelming majority (96.9%) continue to deepen their expertise in related cutting-edge fields such as Data Science, Artificial Intelligence, and Computer Science. This demonstrates that the program has laid a solid academic foundation for students and successfully inspired their interest in pursuing higher-level research within their professional domain, with the remaining (3.1%) in other fields.

Doctor of Data Science Program

Since the establishment of the Data Science Doctoral program, 42 graduates have successfully completed their studies at our university. According to the graduate survey report, most graduates are male (76.2%), while females constitute a smaller proportion (23.8%). The graduates are primarily from Mainland China (97.6%), with the remainder from Macao (2.4%, totaling 1 individual). Regarding career prospects, most graduates hold an optimistic attitude (83.3%), while some are relatively optimistic (16.7%). Currently, most graduates are employed (90.5%), while a minority have chosen to pursue entrepreneurship (9.5%).

Employment:

According to the graduate survey report, employed graduates work in data science-related roles (63.2%), a minority work in computing and data education-related fields (18.4%), followed by network engineering and security (7.9%) and software development (7.9%), with a small number working in other fields (2.6%). These graduates are almost entirely employed in Mainland China (97.4%), with a very small number working in Macao (2.6%). The main factors influencing their choice of current job are personal interest (36.8%) and relevance to their field of study (36.8%), followed by their own capabilities (18.5%) and salary and benefits (7.9%).

Entrepreneurship:

The proportion of doctoral graduates who have started their own businesses is 9.5%. These entrepreneurs have all chosen to establish their ventures in the technology sector. This indicates that a notable portion of doctoral graduates are engaging in entrepreneurial activities, particularly within the technology field. This trend suggests that individuals with advanced degrees are driving innovation and economic growth through the creation of technology enterprises.

Research and Innovation

Overview of research areas and focus

In 2022, the Academy made significant progress in research and innovation, committed to advancing the development of data science, and guided multiple groundbreaking projects with a total amount of approximately MOP4,056,000. In addition to funded projects, the Academy also published a large number of papers in top journals and conferences. These papers covered a variety of topics, including cybersecurity, artificial intelligence, and bioinformatics. To further share their respective expertise, Academy members participated in and delivered keynote speeches at various events. These events provided our Academy members with the opportunity to share their latest research results and insights into the future of data science. Overall, the Academy made significant progress in research and innovation in 2022: a large number of projects were funded, high-level articles were published, and solid partnerships were established with well-known institutions. With the continued dedication and passion of our employees for data science, our Academy will make greater progress in the field of data science in the coming years.

Funded research projects

In 2022, we have successfully obtained approval for research funding of approximately MOP4,056,000. The research areas cover cybersecurity, medical data analysis, collaborative platforms and artificial intelligence, etc. These projects will support our academy members to contribute to the development of Macau and the Greater Bay Area.

Table 6. Funded research projects in 2022

Ref	Funding Unit	Project Title	Grant Amount	Principal Investigator	Key findings and breakthroughs
1	Joint research funding from the Macau Science and Technology Development Fund and the National Natural	Research on cross-border data collaborative management and privacy computing for credit reporting	MOP$1,600,000.00	Prof Wanlei Zhou	Phased achievements: 1. Two articles on blockchain have been written. 2. Two articles on cross-border collaborative construction technology have been written.

	Science Foundation of China (FDCT-NSFC project)	(2022.12.28 – 2026.01.28)			3. One conference article has been written. Talent training: Currently, 3 doctoral students and 4 master students have joined the project. Under the leadership of the project leader and other participating teachers, the students have clear division of labor and the project is carried out in an orderly manner. At present, some students have proposed preliminary solutions, and some students have begun to write relevant papers.
2	Macao Science and Technology Development Fund - General Research Funding	Research on health care data privacy protection model and key technologies for smart medical care in Macau (2022.09.04 – 2024.09.03)	MOP$487,000.00	Associate Professor Zuobin Ying	1. Wrote nine papers in total, three of which were not published; of the six published papers, five were journal papers and one was a conference paper, of which four were included in SCI; six were included in EI; 2. Participated in drafting the "Joint Modeling Process and Privacy Enhancement of Medical Imaging Data" and "Privacy Enhancement Requirements for the Whole Life Cycle of Medical Imaging Data" in the standards of the Chinese Society of Graphics

					3. In terms of talent training, currently trained 1 doctoral student and 9 master students
3	Macau Foundation Project (Research)	Research on the barriers, strategies and technologies of cross-border data transfer in the Greater Bay Area: Taking cross-border data transfer in medical and health care as an example (2022.09 – 2023.06.30)	MOP$240,000.00	Associate Professor Zuobin Ying	1. During the project implementation, this project published or accepted 10 academic papers, including 8 conference papers; 3 papers were submitted; and 1 blue book was completed. 2. This project conducts research on legal barriers, ethical barriers and technical barriers to the circulation of medical and health care data in the Guangdong-Hong Kong-Macao Greater Bay Area. At present, a cross-border medical and health care data blockchain traceability platform is being planned and constructed. 3. A total of 19 backbone and reserve talents have been trained through this project, including: 1 postdoctoral fellow; 1 doctoral student; 12 master students; 5 undergraduates. 4. During the project research, the project leader Ying Zuobin became a member of the IEEE Macau Council and a member of IEEE/CCF

4	Joint research funding from the Macau Science and Technology Development Fund and the Ministry of Science and Technology of China (FDCT-MOST project)	Research and application demonstration of multi-agent collaborative platform for Zhuhai-Macao cooperative manufacturing services (2020.08.21 – 2023.09.21)	MOP$1,729,000.00	Prof Zhiming Cai Associate Professor Chia-Wei Chu	1. This project has published 18 academic papers around the research theme, including 11 SCI-indexed journal papers and 7 international conference papers. 2. A total of 62 invention patents have been applied for, of which 7 have been approved and the rest are in the substantive examination stage. 3. A total of 5 software copyright applications have been approved. 4. In terms of talent training, this project has trained a total of 12 doctoral students and 11 master students. During the project, 7 members continued to study for a doctorate from a master's degree.

Publications

	Q1	**Q2-Q4**	**EI**	**Monograph**	**CSSCI Core Journal**	**General Journal**	**ESCI**	**SCI Indexed**	**Total**
2022	41	22	14	1	1	0	2	62	80

In 2022, the college published a total of 20 papers. Among them, 62 papers were included in SCI, and more than 70% came from Q1 journals. Internationally renowned journals such as IEEE Transactions on Information Forensics and Security (network security topic), IEEE transactions on Computers (data engineering topic), and ACM Computing Surveys (computer review topic) were published. These topics are

consistent with the research direction of our teachers and the future development of the college. Please see the appendix below for the complete list of papers published by the college in 2022.

Invited talks, keynote speeches, and conference engagements

In 2022, our college actively organized a number of activities and encouraged faculty and staff to actively participate. These activities not only help us to have in-depth exchanges with other institutions and accelerate the process of cooperation, but also provide us with a platform to show the latest research results and unique insights to the outside world.

1. **The list of faculty members who have participated in academic seminars as guest speakers**

Table 7. Faculty members who have participated in academic seminars

Ref	Event Name	Organizer	Date	Keynote Speaker
1	"Balancing Privacy, Fairness, and Accuracy in Machine Learning Models: A Case Study from Cybersecurity Perspective"	The 2002 International Symposium on Data Security and Privacy Protection, Xi'An, China	2022/12/10	Prof Wanlei Zhou
2	"Mitigate the Impact of Advanced Persistent Threats"	The 5th International Conference on Big Earth Data (BED2022), Wuhan, China	2022/11/12-13	Prof Wanlei Zhou
3	Using Game Theoretic Approach to Defend against Advanced Persistent Threats	The 15th China Computer Networks and Information Security Conference & 2022 International Network Security Seminar, Zhengjiang, China	2022/10/25-27	Prof Wanlei Zhou
4	Maritime Silk Road Forum	School Planning, Construction and Development Center of the Ministry of Education	2022/12/19	Associate Professor Zuobin Ying

2. National policy-related activities

Table 9. National policy-related events

Ref	Meeting Name	Organizer	Date	Participate
1	Symposium for representatives of grassroots associations and youth groups in Macao to learn the spirit of the 20th National Congress	Central Propaganda Team	2022/12/03	Assistant Professor Weng Tak Kuok

3. Invite experts to give lectures

Table 10. Expert lectures

Ref	Category	Seminar Topic	Date	Presenter
1	Academic Lectures	Macau Cross-border Data Seminar	2022/3/18	Academician Fang Binxing
2	Academic Lectures	Dealing with Advanced Persistent Threats: Case Studies	2022/04/20	Prof Wanlei Zhou
3	Academic Lectures	Privacy preserving data sharing against malicious attacks	2022/05/04	Prof. Shen Hong
4	Academic Lectures	Enterprise digital transformation trends and practical paths	2022/11/03	Mr. Ding Yahui

Faculty Development and Achievements

Academic hiring and promotions

Table 11. Recruitment plan for academic staff

	Professors	Associate Professors	Assistant Professors	Lecturers
Year 23/24 Semester 1	0	0	9	0
Year 23/24 Semester 2	2	1	2	0
Sub-Total	2	1	11	0
Total new academic Staff	**14**			

In the past year, we have successfully recruited 14 new employees, including 2 professors, 1 associate professor, and 11 associate professors. Their research areas cover AI, network security, data analysis, bioinformatics, etc. All full-time academic staff have doctoral degrees and overseas study experience.

Recruitment Strategy and Promotions

1. Through overseas visits for recruitment

Following last year's visit to Australia, Singapore or other countries and regions, we will directly conduct initial face-to-face exchanges and introduce them to our university's recruitment system.

2. Through recommendations from partner universities

Establish cooperative relationships with other universities and institutions, such as conducting joint training, exchange visits and other activities with well-known domestic and foreign universities and research institutions to expand the source of talent.

3. Attracting talent through project exchanges or academic conferences

i. Actively participate in academic conferences and seminars at home and abroad to enhance the reputation and influence of the college and attract more outstanding talents to join.

ii. Encourage teachers and researchers to participate in research project exchanges, which will not only enhance research capabilities and results, but also attract more outstanding talents to join.

D. Attracting talent through internal talent optimization system of the faculty

i. Provide good teacher training and development programs to help teachers continuously improve their professional skills and academic level.

ii. Establish an effective teamwork mechanism to improve work efficiency and results.

iii. Provide good international platforms and exchange opportunities to encourage teachers and researchers to participate in international cooperation and exchange activities.

Awards and honors received by faculty members

Our faculty has encouraged our staff and students to participate in various competitions internally and externally. For example, our team has been awarded No.1 in Huawei ICT competition in Macao.

Table 12. Awards received by faculty members

Competition Name	Awards	Awardees	Instructor	Date
Huawei's 6th Global ICT (Information and Communications Technology) Competition	Third Prize in Network Track	Jin Yuxin、Ma Xiaochen and Liu Yunzhi	Associate Professor Zuobin Ying	2022/3
Guangdong-Hong Kong-Macao Greater Bay Area IT Application System Development Competition	Winner	Wang Jiaxu、Yang Ruochen、Zheng Guangyuan、Zhou Zhejun	Associate Professor Chia-Wei Chu	2022/9/16
Guangdong-Hong Kong-Macao Greater Bay Area IT Application System Development Competition	Winner	Kang Jiajing、Wang Yaokang、Li Yaxuan	Associate Professor Chia-Wei Chu、Assistant Professor Hoi Io Kong	2022/9/16

2022 Macau Cyber Security Technology Competition	University Category Silver Award	XiongJinxinag、Ni Ertai、Pan Zuoqun、Zhou Qihe		2022/9/18
2022 Macau Cyber Security Technology Competition	Open Category Merit Award	Jin Yuxin、Ma Chenxiao、Kong Yitong、Xiang Yuwen		2022/9/18
2022 年中國高校計算機大賽-網絡技術挑戰賽	National First Prize	Kong Lingyan、Hu Jinghao	Associate Professor Chia-Wei Chu	2022/9
"China Optics Valley. Huawei Cup" The 19th China Graduate Mathematical Modeling Competition"	National First Prize	Luo Haiyou		2022/10

Leadership roles and contributions in professional organizations

We encourage our faculty members to take diverse leadership roles in the community. These activities can help us train our members to be future leaders and contribute our faculty members' expertise to the communities.

Table 13. Leadership roles in Macau society

Organization Name	Position	Academic Staff
Macau Science and Technology Association	Vice President	Prof Wanlei Zhou
Macau Science and Technology Committee	Member	
Macau Science and Technology Association	director	Associate Professor Wenjian Liu
Macau Higher Education Promotion Association	director	
Guangdong Association for Science and Technology	Special Invited Members from Hong Kong and Macao	
Chengdu Overseas Chinese Association	director	

Macau International Cultural and Educational Exchange Association	Vice Chairman and Secretary General	
Macau Smart City Association	Chief Supervisor	
Macau Science and Technology Education Association	Vice President	
Academic Committee of Yunnan Provincial Key Laboratory of Software Engineering	Member, Distinguished Professor	
IEEE Macau Council	director	Associate Professor Zuobin Ying
IEEE / CCF	member	
Blockchain Committee of the Chinese Society of Industrial and Applied Mathematics	Member	
Guangdong Science and Technology Business Incubator Association	Guangdong Province Entrepreneurship Mentor	
Macau Greater Bay Area Digital Economy Association	Vice President	Assistant Professor Weng Tak Kuok
Macau Physics Olympiad Center	Vice Chairman	Assistant Professor Hoi Io Kong
Macau Meteorological Society	director	

Strategic Planning and Future Directions

Vision and mission statement

We are committed to building the School of Data Science into a leading data science research and education platform in Macau and the core of the Greater Bay Area. Through cutting-edge technology exploration, interdisciplinary cooperation and innovative talent training, we will promote the widespread application of data science in scientific research, industry and social services, and provide strong talent, education and intellectual support for the sustainable development and digital transformation of the Greater Bay Area. We will work closely with all sectors to jointly promote knowledge innovation and technological application in the field of data science, follow the glorious tradition of patriotism and love for Macau of our City University of Macau, tell Chinese stories well, promote Chinese culture, and integrate into the overall national development with the mission of "rooting in Macau and integrating into the Bay Area", and contribute to the talent training of the Guangdong-Hong Kong-Macao Greater Bay Area and even the country.

Goals and objectives for the upcoming years

To realize our vision, in the next 3-5 years, we have the following goals:

- We plan to enter the top 500 in ARWU of data science subject by 2027;
- Establish a key laboratory at or upper the provincial level that leads by the faculty of data science;
- Our new major, Electronic Computer Engineering (Bachelor, Master and Doctoral programs), can be approved by the Education and Youth Development Bureau of Macau;
- The student-teacher ratio of the faculty can be reached to 18:1;
- Within 3 years, our student numbers reach 2000.

Challenges and opportunities

To achieve these goals, our Faculty of Data Science will face several challenges and opportunities:

Challenge:
Interdisciplinary cooperation and communication: The wide application of data science in scientific research, industry and social services requires us to have close interdisciplinary cooperation with other colleges and fields. However, the knowledge

systems and research methods in different fields may differ, and how to communicate and cooperate effectively is an important challenge.
Technology update and iteration: The technology and tools in the field of data science are constantly developing and updating, requiring teachers and students in our college to keep learning and progressing continuously to keep up with the times. At the same time, we also need to continuously update and optimize the curriculum to ensure that the teaching content keeps pace with industry needs.
Attracting better talents: Attracting the best data science talents has always been the purpose of our college, and we face competition from universities around the world. We strive to provide these talents with high-quality research resources and environment, and also provide necessary support and services to help them smoothly transition and integrate into the new environment.

Opportunities:

Opportunities for recent great development of City University of Macau: Our has ushered in great development opportunities in the international environment and scientific and technological resources in recent years. We have more students, better researchers, and greater investment in education, and greater social support. Our School of Data Science must continue to make progress and promote the development of the school under this major development trend.

Opportunities of rising of artificial intelligence and big data: The rapid development of artificial intelligence and big data has provided powerful tools and algorithms for data science, helping us to better process and analyze data. At the same time, these technological advances also provide us with new research directions and application areas. This enables our college to better find our own positions in industry, academia and research development.

Society's demand for data science is growing: With the acceleration of digital transformation, the demand for data science from all areas continues to grow. In scientific research, industry or social services, we are required to provide professional support and solutions. This provides our graduates with a broad job market and development prospects.

Our School of Data Science faces some challenges as well as many incredible opportunities. We need to actively respond to those challenges and make full use of those opportunities to promote our faculty with the scientific research, industry and social progress of the Greater Bay Area.

Conclusion

As the year draws to a close, it is time to look back on our 2022.

This year, the college welcomed new and dynamic members and held a variety of teacher-student exchange activities; we expanded academic boundaries with groundbreaking strategic cooperation and reaped fruitful results in professional research and teaching;

The foundation of these achievements stems from the consistent dedication, selfless collaboration and mutual support of all faculty and staff - it is this cohesion that has made our team core more resilient and confident than ever before. Entering the new journey of 2023, we will continue to move forward with the concept of innovation, determined to become a leader in the field of data science in the Guangdong-Hong Kong-Macao Greater Bay Area, and win international recognition with outstanding achievements.

Appendix

FDS Publication (including papers and monograph)

1. Zhang, G., Liu, B., Zhu, T., Zhou, A., & Zhou, W. (2022). Visual privacy attacks and defenses in deep learning: a survey. Artificial Intelligence Review, 55(6), 4347-4401.
2. Tian, H., Zhu, T., & Zhou, W. (2022). Fairness and privacy preservation for facial images: GAN-based methods. Computers & Security, 122, 102902.
3. Zhao, Y., Liu, B., Zhu, T., Ding, M., & Zhou, W. (2022). Private-encoder: Enforcing privacy in latent space for human face images. Concurrency and Computation: Practice and Experience, 34(3), e6548.
4. Zhang, T., Zhu, T., Liu, R., & Zhou, W. (2022). Correlated data in differential privacy: definition and analysis. Concurrency and Computation: Practice and Experience, 34(16), e6015.
5. Shen, S., Zhu, T., Wu, D., Wang, W., & Zhou, W. (2022). From distributed machine learning to federated learning: In the view of data privacy and security. Concurrency and Computation: Practice and Experience, 34(16), e6002.
6. Cheng, Z., Ye, D., Zhu, T., Zhou, W., Yu, P. S., & Zhu, C. (2022). Multi-agent reinforcement learning via knowledge transfer with differentially private noise. International Journal of Intelligent Systems, 37(1), 799-828.
7. Tian, H., Zhu, T., Liu, W., & Zhou, W. (2022). Image fairness in deep learning: problems, models, and challenges. Neural Computing and Applications, 34(15), 12875-12893.
8. Ye, D., Shen, S., Zhu, T., Liu, B., & Zhou, W. (2022). One Parameter Defense—Defending Against Data Inference Attacks via Differential Privacy. IEEE Transactions on Information Forensics and Security, 17, 1466-1480.
9. Xu, Z., Ren, H., Liang, W., Xia, Q., Zhou, W., Zhou, P., ... & Li, M. (2022). Near Optimal Learning-Driven Mechanisms for Stable NFV Markets in Multitier Cloud Networks. IEEE/ACM Transactions on Networking, 30(6), 2601-2615.
10. Zong, T., Zhao, J., Xiang, Y., Natgunanathan, I., Gao, L., & Zhou, W. (2022). Desynchronization-attack-resilient audio watermarking mechanism for stereo signals using the linear correlation between channels. World Wide Web, 25(1), 357-379.
11. Zhu, C., Ye, D., Zhu, T., & Zhou, W. (2022). Time-optimal and privacy preserving route planning for carpool policy. World Wide Web, 25(3), 1151-1168.

12. Abahussein, S., Cheng, Z., Zhu, T., Ye, D., & Zhou, W. (2022, March). Privacy-Preserving in Double Deep-Q-Network with Differential Privacy in Continuous Spaces. In AI 2021: Advances in Artificial Intelligence: 34th Australasian Joint Conference, AI 2021, Sydney, NSW, Australia, February 2–4, 2022, Proceedings (pp. 15-26). Cham: Springer International Publishing.
13. Ye, D., Zhu, T., Zhou, S., Liu, B., & Zhou, W. (2022). Label-only Model Inversion Attack: The Attack that Requires the Least Information. arXiv preprint arXiv:2203.06555.
14. Ye, D., Chen, H., Zhou, S., Zhu, T., Zhou, W., & Ji, S. (2022). Model Inversion Attack against Transfer Learning: Inverting a Model without Accessing It. arXiv preprint arXiv:2203.06570.
15. Ye, D., Shen, S., Zhu, T., Liu, B., & Zhou, W. (2022). One Parameter Defense—Defending Against Data Inference Attacks via Differential Privacy. IEEE Transactions on Information Forensics and Security, 17, 1466-1480.
16. Liu, C., Chen, H., Zhu, T., Zhang, J., & Zhou, W. (2022). Making DeepFakes more spurious: evading deep face forgery detection via trace removal attack. arXiv preprint arXiv:2203.11433.
17. Zhang, G., Liu, B., Tian, H., Zhu, T., Ding, M., & Zhou, W. (2022). How Does a Deep Learning Model Architecture Impact Its Privacy?. arXiv preprint arXiv:2210.11049.
18. Rezaeibagha, F., Mu, Y., Huang, K., Chen, L., & Zhang, L. (2022). Authenticable Additive Homomorphic Scheme and its Application for MEC-based IoT. IEEE Transactions on Services Computing.
19. Xue Y., Chen L., Mu Y., Zeng L., Rezaeibagha F., Deng R. H. (2022), Structured encryption for knowledge graphs, Information Sciences 605, 43-70
20. Zhang T., Zhang L., Wu Q., Mu Y., Rezaeibagha F. (2022), Redactable Blockchain-Enabled Hierarchical Access Control Framework for Data Sharing in Electronic Medical Records, IEEE Systems Journal
21. Zhang L,, Zhao C., Wu Q., Mu Y., Rezaeibagha F. (2022), A traceable and revocable multi-authority access control scheme with privacy preserving for mHealth, Journal of Systems Architecture 130, September 2022, 102654
22. Su J., Zhang L., Mu Y. (2022), BA-RMKABSE: Blockchain-aided Ranked Multi-keyword Attribute-based Searchable Encryption with Hiding Policy for Smart Health System, Future Generation Computer Systems 132, 299-309
23. Chen L., Fu Q., Mu Y., Zeng L., Rezaeibagha F., Hwang M. S. (2022). Blockchain-based random auditor committee for integrity verification, Future Generation Computer Systems 131, 183-193

24. Wu Q., Lai T., Zhang L., Mu Y., Rezaeibagha F. (2022). Blockchain-enabled multi-authorization and multi-cloud attribute-based keyword search over encrypted data in the cloud, Journal of Systems Architecture 129, August, 102569
25. Li X., Xiang T., Mu Y., Guo F., Yao Z. (2022). C-Wall: Conflict-Resistance in Privacy-Preserving Cloud Storage, IEEE Transactions on Cloud Computing
26. Zhou Y., Wang Z., Qiao Z., Wang Y., Yang B., Mu Y., Zhang M.. (2022). Identity-Based Encryption With Continuous Leakage-Resilient CCA Security From Static Complexity Assumption, The Computer Journal
27. Chen L., Xue Y., Mu Y., Zeng L., Rezaeibagha F., Deng R. (2022). CASE-SSE: Context-aware Semantically Extensible Searchable Symmetric Encryption for Encrypted Cloud Data, IEEE Transactions on Services Computing
28. Zhang L., Zhang Y., Wu Q., Mu Y., Rezaeibagha F. (2022). A Secure and Efficient Decentralized Access Control Scheme Based on Blockchain for Vehicular Social Networks, IEEE Internet of Things Journal
29. Yuan M., Mu Y., Rezaeibagha F., Xu L., Huang X. (2022), Controllable software licensing system for sub-licensing, Journal of Information Security and Applications 64, 103061
30. Huang K., Zhang X., Mu Y., Rezaeibagha F., Huang X., Gong Y. (2022), Blockchain-based deduplication with arbitration and incentives, IET Information Security
31. Wu Q., Li L., Zhang L,, Mu Y., Rezaeibagha F. (2022), Secure and Efficient General Circuits Attribute-Based Access Control in Cloud Computing, IEEE Systems Journal
32. Peng, S., Cai, Z., Liu, W., Wang, W., Li, G., Sun, Y., & Zhu, L. (2022). Blockchain Data Secure Transmission Method Based on Homomorphic Encryption. Computational Intelligence and Neuroscience, 2022.4.
33. Lumin Xing*, Wenjian Liu, Xiaoliang Liu, Xin Li and Han Wang, （2022）Use of deep learning in nano image processing through the CNN model", in Advances in Nano Research Volume 12, Number 2, February 2022 , pages 185-195, DOI: 10.12989/anr.2022.12.2.185.
34. Xing, L., Liu, W., Li, X., Wang, H., Jiang, Z., & Wang, L. (2022). Application of machine learning and deep neural network for wave propagation in lung cancer cell. ADVANCES IN NANO RESEARCH, 13(3), 297-312.
35. Guo, T., Chu, C., Gao, J., Wang, M. & Lu, W. (2022). Research on Box Office Prediction of Commercial Films Based on Internet Search Index and Multilayer Perceptron.
36. Lu, Y. & Chu, C. (2022). A Novel Piano Arrangement Timbre Intelligent Recognition System Using Multilabel Classification Technology and KNN Algorithm [Electronic version]. Computational Intelligence and Neuroscience, vol. 2022, 9 pages, 2022.

https://doi.org/10.1155/2022/2205936

37. Xu, Z., & Zhu, J. (2022). Application of Sensor and Fuzzy Clustering Algorithm in Hybrid Recommender System. Journal of Sensors, 2022.
38. Kuang, J., Chang, T., & Chu, C. (2022). Research on Financial Early Warning Based on Combination Forecasting Model. Sustainability, 14(19), 12046.
39. Ying, Z., Cao, S., Liu, X., Ma, Z., Ma, J., & Deng, R. H. (2022). PrivacySignal: Privacy-Preserving Traffic Signal Control for Intelligent Transportation System. IEEE Transactions on Intelligent Transportation Systems
40. Zhang, Y., Ying, Z., & Chen, C. P. (2022). Achieving Privacy-Preserving Multi-Task Allocation for Mobile Crowdsensing. IEEE Internet of Things Journal
41. Zhang, J., Li, T., Ying, Z., & Ma, J. (2022). Trust-Based Secure Multi-Cloud Collaboration Framework in Cloud-Fog-Assisted IoT. IEEE Transactions on Cloud Computing
42. Meng, X., Yang, Y., Li, K., & Ying, Z. (2022). A Structure-Aware Adversarial Framework with the Keypoint Biorientation Field for Multiperson Pose Estimation. Wireless Communications and Mobile Computing, 2022
43. Wu, B., Wu, Q., & Ying, Z. (2022). GAP-MM: 5G-Enabled Real-Time Autonomous Vehicle Platoon Membership Management Based on Blockchain. Security and Communication Networks, 2022
44. Zhang, Y., Ying, Z., Zhao, B., & Chen, C. L. P. (2022). A privacy preserving data aggregation and query for metro passenger flow via mobile crowdsensing. Concurrency and Computation: Practice and Experience, e6965
45. Wang, Z., Zhang, J., Liu, Y., Lu, M., Ying, Z., & Ma, J. (2022). A certificateless authentication scheme with fuzzy batch verification for federated UAV network. International Journal of Intelligent Systems
46. ZHONG, Y., BI, R., YAN, X., YING, Z., & XIONG, J. (2022). Efficient homomorphic neural network supporting privacy-preserving training. Journal of Computer Applications, 42(12), 3792.
47. Zhang, J., Wang, Y., Ma, Z., Yang, X., Ying, Z., & Ma, J. (2022). A Location-Aware Verifiable Outsourcing Data Aggregation in Multi-blockchains. IEEE Internet of Things Journal.
48. Zhang, Y., Wei, X., Cao, J., Ning, J., Ying, Z., & Zheng, D. (2022). Blockchain-Enabled decentralized Attribute-Based access control with policy hiding for smart healthcare. Journal of King Saud University-Computer and Information Sciences, 34(10), 8350-8361.

49. You, X., Liu, X., Jiang, N., Cai, J., & Ying, Z. (2022). Reschedule Gradients: Temporal Non-IID Resilient Federated Learning. IEEE Internet of Things Journal, 10(1), 747-762.
50. Bi, R., Zhao, M., Ying, Z., Tian, Y., & Xiong, J. (2022). Achieving dynamic privacy measurement and protection based on reinforcement learning for mobile edge crowdsensing of IoT. Digital Communications and Networks.
51. Wang, Y., Wang, P., Kong, H., & Wong, C. S. (2022). Tsunamis in Lingding Bay, China, caused by the 2022 Tonga volcanic eruption. Geophysical Journal International.
52. Albert, C. C. Y., Zhu, L., Li, G., Guo, Y., Li, X., & Luo, R. (2022, January). Research on hotel energy intelligent monitoring system and service improvement based on data mining and cloud computing. In 2022 IEEE 2nd International Conference on Power, Electronics and Computer Applications (ICPECA) (pp. 871-874). IEEE.
53. Feng, X., Cui, K., Jiang, H., & Wang, L. (2022). A Source Authentication Scheme For Road Condition Monitoring Using Consortium Blockchain. IEEE Transactions on Vehicular Technology.
54. Liu, Y., Zhang, L., Zhou, Y., Xu, Q., Fu, W., & Shen, T. (2022). Clustering-Based Decision Tree for Vehicle Routing Spatio-Temporal Selection. Electronics, 11(15), 2379.
55. Wang, H., Yang, J., Wu, Y., Du, W., Fong, S., Duan, Y., ... & Wu, F. (2022). Deep learning for macular fovea detection based on ultra-widefield Fundus images.Computational and Mathematical Methods in Medicine. Doi:10.20944/preprints202108.0469.v2, https://doi.org/10.1155/1970/6237967.
56. Yili Chen, Congdong Li* and Han Wang*.(2022), Big Data and Predictive Analytics for Business Intelligence: A Bibliographic Study (2000–2021). Forecasting, 4(4), 746-786. 10.3390/forecast4040042.
57. Xing, L. M*., Liu, W. J., Liu, X. L., Li, X., Wang, H., Jiang, Z.M., & Wang, L.L. (2022). Application of machine learning and deep neural network for wave propagation in lung cancer cell, Advances in Nano Research, 2022, 13(3), 297-312, https://doi.org/10.12989/anr.2022.13.3.297
58. Xing, L. M*., Liu, W. J., Liu, X. L., Li, X., & Wang, H. (2022). Use of deep learning in nano image processing through the CNN model. Advances in Nano Research, 12(2), 185-195. https://doi.org/10.12989/anr.2022.12.2.185
59. Hou, S. H., Qiao, L. Y., & Xing, L. M.* (2022). Artificial neural fuzzy system and monitoring the process via IoT for optimization synthesis of nano-size polymeric chains. Advances in Nano Research, 12(4), 375-386. https://doi.org/10.12989/anr.2022.12.4.375

60. Liu, J., Xing, L. M*., & Shi, X. (2022). Application of intelligent management mode for drugs and consumables in anesthesiology department. European Review for Medical and Pharmacological Sciences, 26(14), 5053-5062. https://doi.org/10.26355/eurrev_202207_29291

61. Ma Y, Lv W. Identification of Pneumonia in Chest X-Ray Image Based on Transformer. https://doi.org/10.1155/2022/5072666, Volume 2022: Article ID 5072666.

62. Huang, C., Zhang, W., & Xue, L. (2022). Virtual reality scene modeling in the context of Internet of Things. Alexandria Engineering Journal, 61(8), 5949-5958.

63. Tan, J., & Li, Y*. (2022). A Topology Graph Algorithm Based on Lattice-Valued Logic to Solve Satisfiability Problems. Mathematical Problems in Engineering, 2022.

64. Zhu, L., Song, S., Peng, S., Wang, W., Hu, S., & Lan, W. (2022, August). The Blockchain and Homomorphic Encryption Data Sharing Method in Privacy-Preserving Computing. In 2022 IEEE/ACIS 7th International Conference on Big Data, Cloud Computing, and Data Science (BCD) (pp. 84-87). IEEE.

65. Ying Z, Lan W, Liu L. (2022). A DPoS-based In-game Items Trading System With Forum[C]. The 15th China Computer Networks and Information Security Conference & 2022 International Network Security Seminar.

66. J. Liu, Y. Zhang, B. Gong, W. Lu and Y. Xiao, "Research on Text-based Q&A System Technology for Medical Aesthetic Field," 2022 IEEE/ACIS 22nd International Conference on Computer and Information Science (ICIS), 2022, pp. 14-19, doi: 10.1109/ICIS54925.2022.9882415.

67. Liu, Y., Zhang, L., Zhou, Y., Xu, Q., Fu, W., & Shen, T. (2022). Clustering-Based Decision Tree for Vehicle Routing Spatio-Temporal Selection. Electronics, 11(15), 2379.

68. Guo, Y., Yan, X., Ma, L., Tang, L., & Huang, Y. (2022, November). A Pupil Segmentation Framework with Masked Image Modeling Enhanced Swin-Transformer. In 2022 IEEE International Conference on Bioinformatics and Biomedicine (BIBM) . IEEE.

69. 应作斌, 方一晨*, 张怡文. DP-DFL：动态聚合权重的隐私保护联邦学习框架[J]. 网络与信息安全学报, 2022, 8(5).

70. Zuobin Ying, Minghao Liu, Siofong Kong, Shengmin Xu & Jinbo Xiong (2022) Anonymous Hierarchical Identity-based Encryption EHR Sharing Mechanism Based on SM9. The 21th International Conference on Ubiquitous Computing and Communications (IUCC)

71. Ying Z, Yang H, Chu C, Xu S. (2022). ZRA: A Secure and Radical Auction Scheme for Blockchain with Privacy Preservation. The 21th International Conference on

Computer and Information Technology (CIT).

72. Wang, H., Yang, J., Wu, Y., Du, W., Fong, S., Duan, Y., ... & Wu, F. (2022). Deep learning for macular fovea detection based on ultra-widefield Fundus images.Computational and Mathematical Methods in Medicine. Doi:10.20944/preprints202108.0469.v2, https://doi.org/10.1155/1970/6237967.
73. Yili Chen, Congdong Li* and Han Wang*.(2022), Big Data and Predictive Analytics for Business Intelligence: A Bibliographic Study (2000–2021). Forecasting, 4(4), 746-786. 10.3390/forecast4040042.
74. Xing, L. M*., Liu, W. J., Liu, X. L., Li, X., Wang, H., Jiang, Z.M., & Wang, L.L. (2022). Application of machine learning and deep neural network for wave propagation in lung cancer cell, Advances in Nano Research, 2022, 13(3), 297-312, https://doi.org/10.12989/anr.2022.13.3.297
75. Xing, L. M*., Liu, W. J., Liu, X. L., Li, X., & Wang, H. (2022). Use of deep learning in nano image processing through the CNN model. Advances in Nano Research, 12(2), 185-195. https://doi.org/10.12989/anr.2022.12.2.185
76. Hou, S. H., Qiao, L. Y., & Xing, L. M.* (2022). Artificial neural fuzzy system and monitoring the process via IoT for optimization synthesis of nano-size polymeric chains. Advances in Nano Research, 12(4), 375-386. https://doi.org/10.12989/anr.2022.12.4.375
77. Liu, J., Xing, L. M*., & Shi, X. (2022). Application of intelligent management mode for drugs and consumables in anesthesiology department. European Review for Medical and Pharmacological Sciences, 26(14), 5053-5062. https://doi.org/10.26355/eurrev_202207_29291
78. Ma Y, Lv W. Identification of Pneumonia in Chest X-Ray Image Based on Transformer. https://doi.org/10.1155/2022/5072666, Volume 2022: Article ID 5072666.
79. Huang, C., Zhang, W., & Xue, L. (2022). Virtual reality scene modeling in the context of Internet of Things. Alexandria Engineering Journal, 61(8), 5949-5958.
80. Tan, J., & Li, Y*. (2022). A Topology Graph Algorithm Based on Lattice-Valued Logic to Solve Satisfiability Problems. Mathematical Problems in Engineering, 2022.