FUNDAMENTALS OF LEARNING AND INFORMATION PROCESSING
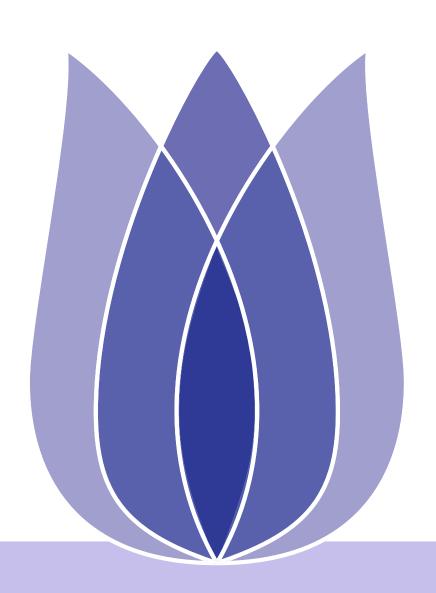# SESSION 20: TULIP APPROACH TO RESEARCH (II)

Gang Li

Deakin University, Australia

2024-03-19

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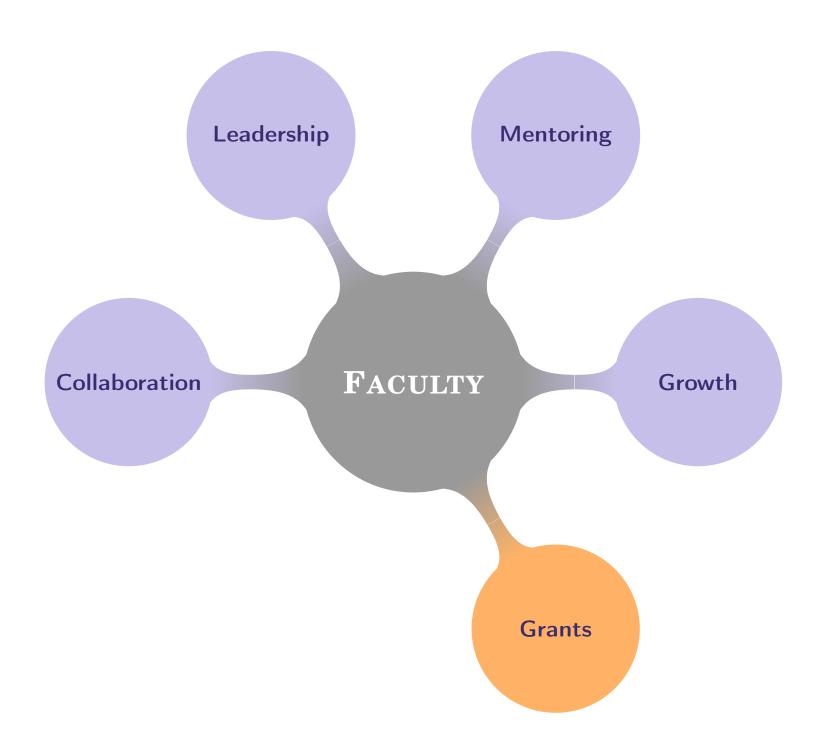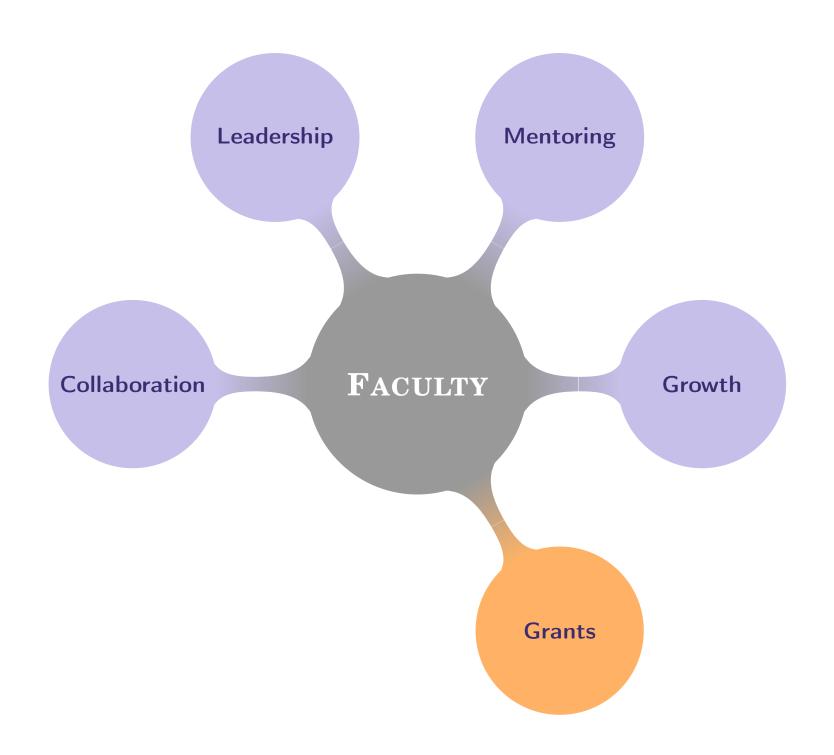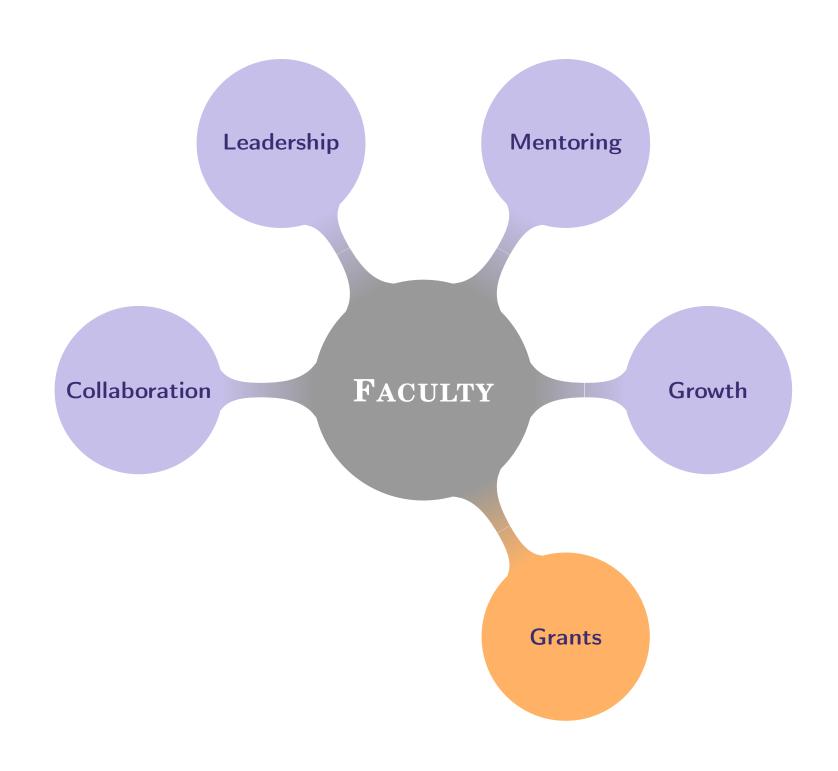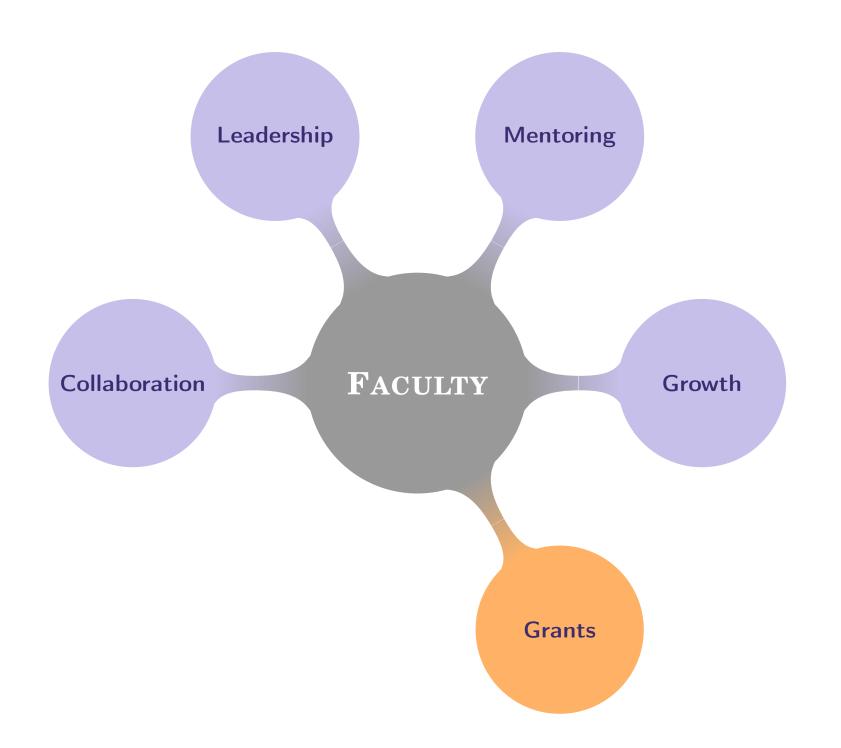
Road to Success

TULIP Academy

■ Professor **Gang Li**

◆ Deakin University

  ■ *University Academic Board Member*

  ■ *University Thesis Examination Committee*

  ■ *Cyber Analytics & AI* leader, Deakin CREST

  ■ *Deputy Director*, Deakin D2I

◆ Academic Services

  ■ IEEE Technical Committee

    ◆ Task Force on *Educational Data Mining*, (Chair 2020-)

    ◆ *Data Mining and Big Data Analytics*, (Vice Chair 2017-2019)

    ◆ *Enterprise Information Systems*

    ◆ *Enterprise Architecture and Engineering*

  ■ IJCAI, AAAI several times as *Area Chair*

  ■ PAKDD, ACML as *Senior PC*

  ■ KSEM, ATIS as *Steering Committee member*

  ■ DSS, IT&T, TM, JTR, APJTR as *Associate Editor*

  ■ Cyber Security, DSS, JIKM, JIFS, IEEE Access as *Associate Editor*

Deakin University

☞ Among the **top** 1 % of universities worldwide, *Computer Science* ranked the **4th** in Australia

Major Rankings.

■ Among the **top** 1 % of universities worldwide (*Shanghai Rankings*)

Deakin University

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- Among the **top** 1 % of universities worldwide (*Shanghai Rankings*)
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- Among the **top** 1 % of universities worldwide (*Shanghai Rankings*)
- Ranked in the **Top** 50 young universities in the world (*QS and Times Higher Education*)
- Ranked in the World **Top** 50 − 75 in *Computer Science and Engineering*, the **4th** in Australia (*Shanghai Rankings* 2023)

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■ Ranked **#1** in Victoria for student satisfaction for the last 11 years (*Australian Graduate Survey*)

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- **#1** university in Australia for *education experience* (*2019 Student Survey*)

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■ **#1** university in Australia for *education experience* (*2019 Student Survey*)

■ **#1** university in Australia for *careers service*(*Australian Graduate Recruitment Industry Awards*)

Deakin University

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Table 1: Major Rankings of Deakin University

	Benchmark	2014-2015	2015-2016	2016-2017	2017-2018
ARWU	World	301-400	201-300	201-300	201-300
	National	12-19	9-14	11-14	10-15
CWTS Leiden	World	284	325	314	226
	National	11	17	17	11
QS#	World	360	324	355	293
	National	19	17	19	17
THE	World	301-350	301-350	251-300	301-350
	National	13-15	18-19	12-18	17-21
THE<50	World	45	50	43	50
	National	6	8	8	8

https://www.australianuniversities.com.au/rankings/

Team for Universal Learning and Intelligent Processing

👍 Focus on Intelligent Techniques

Research Areas.

Artificial Intelligence automate various intelligent tasks using advanced algorithms

Team for **U**niversal **L**earning and **I**ntelligent **P**rocessing

👍 Focus on Intelligent Techniques

Research Areas.

Artificial Intelligence automate various intelligent tasks using advanced algorithms

Privacy & Security Cyber-security and How to preserve the privacy of individuals while analyzing the data

Team for Universal Learning and Intelligent Processing

👍 Focus on Intelligent Techniques

Research Areas.

Artificial Intelligence   automate various intelligent tasks using advanced algorithms

Privacy & Security   Cyber-security and How to preserve the privacy of individuals while analyzing the data

Business Intelligence   support business decision-making using data science and artificial intelligence.

Team for Universal Learning and Intelligent Processing

👍 Focus on Intelligent Techniques

Research Areas.

Artificial Intelligence automate various intelligent tasks using advanced algorithms

Privacy & Security Cyber-security and How to preserve the privacy of individuals while analyzing the data

Business Intelligence support business decision-making using data science and artificial intelligence.

AI Applications AI and data science applications in various domains

Web Resources

Official Websites

- **G**: Google Scholar
- 🏠: `https://www.tulip.org.au`
- : `https://github.com/tulip-lab`

Social Media

- : Twitter
- : Reddit
- **in**: Linkedin

Opportunities for *Research Students*

👉 Cutting-edge AI, cybersecurity & privacy research topics

☛ Cutting-edge AI, cybersecurity & privacy research topics

State of the Art.

■ gain immersive practical experience working on the frontlines of AI, cybersecurity and privacy research.

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■ gain immersive practical experience working on the frontlines of AI, cybersecurity and privacy research.

■ develop new models, test defensive strategies, analyze real-world data for privacy risks

Team for Universal Learning and Intelligent Processing

👉 Cutting-edge AI, cybersecurity & privacy research topics

State of the Art.

- gain immersive practical experience working on the frontlines of AI, cybersecurity and privacy research.
- develop new models, test defensive strategies, analyze real-world data for privacy risks
- contribute to innovative research prototypes and systems.

👉 One-on-one mentoring from TULIP-LAB supervisors

Mentorship

Skills

Experience

STUDENTS

Frontiers

Publications

☞ One-on-one mentoring from TULIP-LAB supervisors

Supervision.

- receive close mentorship from TULIP-LAB faculty members

Mentorship

Skills

Experience

STUDENTS

Frontiers

Publications

👉 One-on-one mentoring from TULIP-LAB supervisors

Supervision.

■ receive close mentorship from TULIP-LAB faculty members

■ mentors will guide students through the research process from ideation to the technical report.

☞ **Highly valuable technical and analytical abilities**

TULIP *Team for Universal Learning and Intelligent Processing*

👉 Highly valuable technical and analytical abilities

Research Skills.

■ build comprehensive skills for research and industry

Team for Universal Learning and Intelligent Processing

Mentorship · Skills · Experience · **STUDENTS** · Frontiers · Publications

👉 Highly valuable technical and analytical abilities

Research Skills.

■ build comprehensive skills for research and industry

■ expected research skills

TULIP *Team for Universal Learning and Intelligent Processing*

Expected Research Skills

TULIP *Team for Universal Learning and Intelligent Processing*

☞ **Explore state-of-the-art advancements in AI, S&P etc.**

Mentorship

Skills

Experience

STUDENTS

Frontiers

Publications

Team for Universal Learning and Intelligent Processing

Mentorship

Skills

Experience

STUDENTS

Frontiers

Publications

👉 Explore state-of-the-art advancements in AI, S&P etc.

Worldly.

- works on the bleeding-edge of AI capabilities and emerging cybersecurity & privacy challenges.

Mentorship

Skills

Experience

STUDENTS

Frontiers

Publications

👉 Explore state-of-the-art advancements in AI, S&P etc.

Worldly.

■ works on the bleeding-edge of AI capabilities and emerging cybersecurity & privacy challenges.

■ attend seminars, conferences and meetings to learn about the latest directly from pioneers in these rapidly evolving fields.

Mentorship

Skills

Experience

Students

Frontiers

Publications

👉 *Opportunities* to co-author impactful research

☞ *Opportunities* to co-author impactful research

Papers.

■ By contributing to cutting-edge projects, top students can co-author publications in prestigious AI, security and privacy venues.

Team for Universal Learning and Intelligent Processing

☞ *Opportunities* to co-author impactful research

Papers.

■ By contributing to cutting-edge projects, top students can co-author publications in prestigious AI, security and privacy venues.

■ This provides exposure, bolsters academic credentials and allows mastering the publication process from conducting rigorous research to communicating findings effectively through publications and presentations.

Opportunities for *Faculty Members*

TULIP *Team for Universal Learning and Intelligent Processing*

👉 Multidisciplinary teamwork

👉 Multidisciplinary teamwork

Collaboration.

■ Collaborate with faculty across disciplines across different sectors to tackle complex, multifaceted AI risk challenges.

Faculty Opportunities ✈ Collaboration

☞ Multidisciplinary teamwork

Collaboration.

- Collaborate with faculty across disciplines across different sectors to tackle complex, multifaceted AI risk challenges.
- Work within collaborative cross-functional teams that unite diverse AI, security, software engineering and domain expertise.

TULIP *Team for Universal Learning and Intelligent Processing*

👉 Driving innovative research initiatives

👉 Driving innovative research initiatives

Editorship.

- lead groundbreaking work on areas like secure and trustworthy AI, AI-powered cybersecurity, privacy-preserving machine learning and more from conceptualization through execution.

Faculty Opportunities ✈ Leadership

☞ Driving innovative research initiatives

Editorship.

■ lead groundbreaking work on areas like secure and trustworthy AI, AI-powered cybersecurity, privacy-preserving machine learning and more from conceptualization through execution.

■ spearhead impactful projects that advance AI capabilities while proactively addressing related cybersecurity and privacy risks.

◆ `ACM TOPML` Special Issue
◆ National Science Review

Collaborative Leadership Examples @ TULIP-Lab

OXFORD
ACADEMIC

NSR National Science Review

Article Navigation

JOURNAL ARTICLE   CORRECTED PROOF

Embrace open-environment machine learning for robust AI

Gang Li ✉, Aswani Kumar Cherukuri

National Science Review, nwad300, https://doi.org/10.1093/nsr/nwad300
Published: 28 November 2023   **Article history ▾**

📄 PDF   ✏ Annotate   ❝ Cite   🔗 Permissions   ⌁ Share ▾

Keywords: open-environment machine learning, artificial general intelligence, automated machine learning, robust AI

Subject: Computer Science

Issue Section: COMPUTER SCIENCE

Humans possess an extraordinary ability to continuously learn and apply knowledge across differe... environments and tasks, and this ability to understand and acquire diverse intellectual capabilitie... referred to as *artificial general intelligence* (AGI). The realization of AGI requires the development o... *artificial intelligence* systems [1] that can operate effectively and safely in complex and uncertain real-world scenarios. Despite significant advances in conventional machine learning over the last few decades, achieving robust AI or ultimate AGI remains a challenge, especially in the era where practical machine learning applications have expanded into open-environment scenarios, such as cybersecurity and multi-agent environments [2], which deviate from the assumptions of a closed environment [3]. These open...

ACM Journals

CALL FOR PAPERS

ACM Transactions on Probabilistic Machine Learning
Special Issue on Probabilistic Methods for Reliable Machine Learning in Open Environments

Guest Editors:
- **Dr Lan Du**, Monash University, Australia, lan.du@ieee.org
- **Prof. Aswani Kumar Cherukuri,** Vellor Institute of Technology, India, cherukuri@acm.org
- **Prof. Gang Li**, Deakin University, Australia, gangli@acm.org
- **Prof. De-Chuan Zhan**, Nanjing University, China, zhandc@nju.edu.cn

Recent advances in machine learning, particularly in deep neural networks and large language models, have driven significant progress in artificial intelligence. These advanced models have achieved state-of-the-art performance in various domains, including natural language processing and computer vision. However, deploying these technologies in open environments, where they encounter diverse real-world data, presents unique challenges like evolving data distributions and emerging classes. These challenges are especially critical in safety-critical systems such as healthcare, autonomous vehicles, and pharmacology, where AI performance directly impacts human well-being.

To ensure transparency and trust and to enable human oversight, understanding the decision-making processes of machine learning models is essential. Probabilistic methods play a crucial role in illuminating the inner workings of these models, quantifying uncertainty, and assessing the reliability and robustness of predictions. This is vital in safety-critical applications where informed and responsible decisions are paramount.

In addition to probabilistic methods, enhancing machine learning models with human-understandable reasoning behind predictions is key to increasing their trustworthiness and facilitating collaboration between humans and machines. Balancing model performance and interpretability makes even complex models comprehensible, unlocking the full potential of machine/deep learning while keeping their decision-making processes transparent and open to scrutiny. The pursuit of Interpretability and Explainability in artificial intelligence promises to lead to accountable AI systems that positively impact various aspects of human society.

With the surge of applications and data from open-environment scenarios, the learning tasks become a grand challenge due to the presence of "unknown unknowns". Embracing these techniques sets the stage for AI applications that align with human values and goals while navigating complex and uncertain real-world environments with greater accuracy and integrity. This special issue invites original contributions that advance the theory and practice of reliable machine learning in Open Environments by employing approaches that use statistical and probabilistic methodologies.

Leadership

Mentoring

Collaboration

FACULTY

Growth

Grants

👉 Shaping the next generation innovators

Leadership

Mentoring

Collaboration

FACULTY

Growth

Grants

👉 Shaping the next generation innovators

Supervision.

■ mentor students and junior researchers, imparting deep technical expertise in related domains.

Leadership · Mentoring · Collaboration · **FACULTY** · Growth · Grants

👉 Shaping the next generation innovators

Supervision.

- mentor students and junior researchers, imparting deep technical expertise in related domains.
- guide them on developing skills as well as research proficiencies like designing robust experiments and publishing at top venues.

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Supervision.

- mentor students and junior researchers, imparting deep technical expertise in related domains.
- guide them on developing skills as well as research proficiencies like designing robust experiments and publishing at top venues.
- be an official external supervisor for PhD students in Deakin University

☞ Continuous learning and career advancement

TULIP *Team for Universal Learning and Intelligent Processing*

☞ Continuous learning and career advancement

Career Development.

■ attend conferences, workshops and certified training programs to stay ahead of the curve on rapidly progressing AI techniques, emerging threats, defensive technologies and research best practices.

TULIP *Team for Universal Learning and Intelligent Processing*

Leadership

Mentoring

Collaboration

FACULTY

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Grants

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- develop skills in research, publishing, technology transition and take on project leadership roles for enriching professional growth.

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■ IEEE Senior membership, etc.

Leadership

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👉 Continuous learning and career advancement

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■ attend conferences, workshops and certified training programs to stay ahead of the curve on rapidly progressing AI techniques, emerging threats, defensive technologies and research best practices.

■ develop skills in research, publishing, technology transition and take on project leadership roles for enriching professional growth.

■ IEEE Senior membership, etc.

■ organize or chair some International conferences:

◆ KSEM Conference Series
◆ ATIS Conference Series

Conferences Chairing Opportunity with TULIP-Lab

Leadership

Mentoring

Collaboration

FACULTY

Growth

Grants

👉 Develop and Apply for research grants

👉 Develop and Apply for research grants

Funding.

■ access to substantial internal and external funding sources to support the pioneering collaborative research

Faculty Opportunities ✈ Grants

👉 Develop and Apply for research grants

Funding.

- access to substantial internal and external funding sources to support the pioneering collaborative research
- Annual Australia-India grant, *Australia-India Cyber and Critical Technology Partnership* (AICCTP)

TULIP *Team for Universal Learning and Intelligent Processing*

👍 Develop and Apply for research grants

Funding.

- access to substantial internal and external funding sources to support the pioneering collaborative research
- Annual Australia-India grant, *Australia-India Cyber and Critical Technology Partnership* (AICCTP)
- India DST's Spark grant, etc.

Road to Success

Enjoy the Journey

Questions?

TULIP *Team for Universal Learning and Intelligent Processing*

Contact Information

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School of Information Technology
Deakin University
Burwood, Victoria 3125, Australia

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⬤ OPEN RESOURCES FROM TULIP-LAB

⌂ TEAM FOR UNIVERSAL LEARNING AND INTELLIGENT PROCESSING, AUSTRALIA