

#### SENIOR MPC RESEARCHER

Technology Innovation Institute (TII), Abu Dhabi

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"Be weird. Be random. Be who you are. Because you never know who would love the person you hide."

## Research Interests

My research focuses on cryptography and information security, emphasising efficient and secure protocols for problems in the area of Multi-party Computation (MPC). My current focus is on MPC for privacy-preserving services on the internet and in the area of Machine Learning and Federated Learning. The topics of cryptography I have been interested in so far include MPC, Verifiable Secret Sharing, Oblivious Transfer, Byzantine Agreement and Broadcast, Privacy-Preserving Machine Learning and Federated Learning.

## **Education**

## **Indian Institute of Science (IISc)**

Bengaluru, India Sep. 2017 - Jul. 2021

Ph. D. IN COMPUTER SCIENCE

3ep. 2017 - Jul. 2021

- Dissertation Area: Secure Multi-party Computation (MPC) & Privacy-Preserving Machine Learning (PPML)
- · Advisor: Prof. Arpita Patra
- CGPA: 9 / 10 (First Class with Distinction)

#### Indian Institute of Science (IISc)

Bengaluru, India

M.Tech. (Research) in Computer Science

Aug. 2014 - Jun. 2017

- Dissertation Area: Secure Multi-party Computation (MPC)
- Advisor: Prof. Arpita Patra
- CGPA: 6.83 / 8 (First Class with Distinction)

## **College of Engineering, Trivandrum (CET)**

Trivandrum, India

B.Tech in Computer Science and Engineering

Jul. 2010 - Apr. 2014

• CGPA: 8.81 / 10 (First Class with Distinction)

# **Professional Experience**

## Technology Innovation Institute (TII)

Abu Dhabi, UAE

SENIOR MPC RESEARCHER

May. 2023 - Present

• Secure Multiparty Computation, Privacy-preserving Machine Learning

#### Technical University (TU) of Darmstadt

Darmstadt, Germany

POST-DOCTORAL RESEARCH IN COMPUTER SCIENCE

Oct. 2021 - Mar. 2023

- Area: Privacy-preserving Services On the Internet (PSOTI)
- Host: Prof. Thomas Schneider
- Research Group: Cryptography and Privacy Engineering (ENCRYPTO)

### Indian Institute of Science (IISc)

Bengaluru, India

RESEARCH ASSOCIATE

RESEARCH INTERN

Aug. 2021 - Sep. 2021

- Research associate under the guidance of Arpita Patra.

#### Darmstadt, Germany

# Technical University (TU) of Darmstadt

Nov. 2019

• Research work under the joint guidance of Thomas Schneider and Arpita Patra.

- The project aimed at improving the efficiency of secure two-party computation.
- Resulted in a publication at USENIX Security Symposium'21.

### **Amazon Development Centre**

Bangalore, India

SOFTWARE DEVELOPMENT ENGINEER (SDE) INTERN

Jul. 2013 - Aug. 2013

• Worked on the project titled "Increase the registered and subscribed user base at Amazon" under the mentorship of Bhanu Pratap Singh in the International Expansion (Junglee Traffic) Team.

# **Awards, Scholarships and Achievements**

- 1. Nominated for the Schmidt Science Fellows 2022 program for post-doctoral research (one among a group of 350 highly accomplished candidates, nominated from 83 of the world's leading universities and institutes).
- 2. Represented country India in the "Window to the World" session at the 8th Heidelberg Laureate Forum.
- 3. Selected as one among 225 young researchers to participate in the 8th Heidelberg Laureate Forum.
- 4. Recipient of Google PhD Fellowship 2019 (one among 53 researchers around the globe).
- 5. Organiser of Secure Multi-Party Computation: Theory and Practice Workshop at Indian Institute of Science (IISc) from 19th to 22nd January, 2020.
- 6. Received travel grant to attend Privacy Preserving Machine Learning Workshop, CCS 2019, London.
- 7. Received travel grant to attend Workshop: Theory and Practice of Secure Multiparty Computation 2016, Aarhus University, Denmark.
- 8. Secured All India Rank of 807 with a score of 688 in GATE 2014 among (approximately) 1,55,190 students in India.
- 9. Ministry of Human Resource and Development (MHRD) Scholarship for Postgraduate education, India.
- 10. Best Outgoing student in Computer Science and Engineering (P Rathnaswamy Memorial Endowment) for the year 2014.
- 11. First prize in Coding Competition, CODESTORM, conducted by IEEE Computer Society (March 2013).
- 12. Received Ashok Leyland "ALL THE BEST" Scholarship for graduate studies, India (February 2011).
- 13. Recipient of Federal Bank Hormis Memorial Foundation Scholarship for graduate studies, India (2010-11).
- 14. Recipient of Indian Oil Education Scholarship for graduate education, India (2010-11).
- 15. Received Central Sector Scholarship by Department of Higher Education (MHRD) for graduate studies, India (2010).
- 16. Achieved a rank of 629 in Kerala Engineering Entrance (KEAM 2010) among (approximately) 100949 students.
- 17. Received Malayala Manorama Merit Scholarship (February 2008).
- 18. Received prize at CMS Math Prodigy Hunt 2009, organized by Centre for Research in Mathematics.
- 19. Participated in 20th Kerala Science Congress, Trivandrum (January 2008).
- 20. Participated in Youth Parliament Competition under the auspices of the Institute of Parliamentary Affairs, Government of Kerala.

# Scientific Service

- 1. Program Committee (PC) member for
  - 2024 IEEE S&P, PETS
  - 2023 ACM CCS, CANS
  - 2022 CANS
- 2. Acted as external reviewer for
  - 2023 USENIX Security, CRYPTO
  - 2022 EUROCRYPT, ACM CCS, PETS, IEEE TDSC (Journal), ICDCN, PINS (Journal), IEEE TC (Journal)
  - 2021 ACM CCS, PODC, ITC, CRYPTO
  - 2020 ASIACRYPT, IEEE TIFS (Journal)
  - 2019 CRYPTO, ASIACRYPT, TCC, PKC
  - 2018 EUROCRYPT, ASIACRYPT
  - 2017 ASIACRYPT, PKC
  - 2016 CRYPTO
- 3. Organiser of EECS Research Students Symposium 2017 at Indian Institute of Science (IISc), Bangalore, India.
- 4. Maintainer of https://mpc-deadlines.github.io.

# **Teaching Experience**

#### Technical University of Darmstadt (TUD)

Darmstadt, Germany

CRYPROT: CRYPTOGRAPHIC PROTOCOLS (TEACHING ASSISTANT)

Summer Term 2022

- · Instructor: Prof. Dr.-Ing. Thomas Schneider
- ENCRYPTO, Department of Computer Science, TUD.
- Conducted course exercises, exam preparation and evaluation.

### Indian Institute of Science (IISc)

Bengaluru, India

CSA E0 312: Secure Computation (Teaching Assistant)

Jan. - Apr.'17, Aug. - Dec.'19

- Instructor: Dr. Arpita Patra
- Department of Computer Science and Automation (CSA), IISc.
- Gave course lectures, mentoring in course projects, evaluation.

#### Indian Institute of Science (IISc)

Bengaluru, India

CSA E0 235: CRYPTOGRAPHY (TEACHING ASSISTANT)

Jan. - Apr.'16, Aug. - Dec.'19

- Instructor: Dr. Arpita Patra
- Department of Computer Science and Automation (CSA), IISc.
- · Conducted weekly tutorial sessions discussing questions from the areas covered in the course, evaluation of exam sheets.

#### Indian Institute of Science (IISc)

Bengaluru, India

UG E101: ALGORITHMS AND PROGRAMMING (TEACHING ASSISTANT)

Aug. - Dec.'18

- Instructors: Satish Govindarajan and Viraj Kumar
- Undergraduate (UG) Department, IISc.
- · Conducted weekly coding tutorial sessions, evaluation of assignments.

# **Projects**

### **College of Engineering, Trivandrum**

Trivandrum, India

BTECH MAIN PROJECT

Jan. - Mar.'14,

- Title: Proximity based Sentiment Analysis with Contextual Phrase Polarity.
- · This aims to find the sentiment or mood of a given text segment (or review) using word proximity.

### **College of Engineering, Trivandrum**

Trivandrum, India

BTECH MINI PROJECT

Jan.'13,

- Title: Student Tracker A complete student management system.
- A tool for managing the student database of a college using Java as front end and Oracle as back end.

#### **College of Engineering, Trivandrum**

Trivandrum, India

OTHER PROJECTS

- A project on Road Safety using mobile controlled speed governor in association with IEEE.
- A project on android device that can convert a base line video to normal high quality video for live streaming, in association with IET and Aceware
  Technology Ltd.

## **Skills**

**Programming** C/C++, Java, Javascript, Python, PyTorch

DevOps AWS, DockerDBMS Oracle, SQL

Web HTML5, CSS3, jQuery, JSP
Tools NetBeans, Eclipse, LTFX

### Personal Data

**Born** 24th April 1992 in Kerala, India

Citizenship Indian
Marital Status Married

Languages Malayalam (mother tongue), English, Hindi, Tamil

**Interests** Photography, Badminton, Cycling

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MAY 3, 2023 AJITH SURESH · CURRICULUM VITAE

# **Research Profile**

# Scientific Publications

#### **THESIS**

- 1. Ajith Suresh. *MPCLeague: Robust MPC Platform for Privacy-Preserving Machine Learning*. PhD Thesis, 2021. Under the supervision of Prof. Arpita Patra. Indian Institute of Science (IISc), Bangalore. [PDF]
- 2. Ajith Suresh. Fast Actively Secure OT Extension for Short Secrets. Master Thesis, 2017. Under the supervision of Prof. Arpita Patra. Indian Institute of Science (IISc), Bangalore. [PDF]
- 3. Ajith Suresh. *Proximity-based Sentiment Analysis with Contextual Phrase Polarity*. Bachelor Thesis, 2014. College of Engineering (CET), Trivandrum.

## **CONFERENCES & JOURNALS**

Publications in cryptography usually order authors alphabetically (using surnames) and conferences ([C]) are more common than journals ([J]). Workshops and affiliated events with proceedings are marked with ‡.

- 1. [J] Nishat Koti, Shravani Patil, Arpita Patra and Ajith Suresh. *MPClan: Protocol Suite for Privacy-Conscious Computations*. In Journal of Cryptology (JoC'23) (CORE rank- A\*) [Full Version]
- 2. [C] Andreas Brüggemann, Robin Hundt, Thomas Schneider, Ajith Suresh and Hossein Yalame. *FLUTE: Fast and Secure Lookup Table Evaluations*. In IEEE Symposium on Security and Privacy (IEEE S&P'23) (CORE rank- A\*) [Full Version]
- [C] Till Gehlhar, Felix Marx, Thomas Schneider, Ajith Suresh, Tobias Wehrle and Hossein Yalame. SafeFL: MPC-friendly framework for Private and Robust Federated Learning<sup>‡</sup>. In Deep Learning Security and Privacy Workshop (DLSP'23) [Full Version]
- 4. [J] Thomas Schneider, Ajith Suresh and Hossein Yalame. *Comments on "Privacy-Enhanced Federated Learning Against Poisoning Adversaries"*. In IEEE Transactions on Information Forensics & Security (IEEE TIFS'23) (CORE rank- A), In IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP'23) [Full Version]

Research work(s) published during PhD. I am the primary author for publications marked with †.

- 5. [C] Nishat Koti, Arpita Patra, Rahul Rachuri and Ajith Suresh. *Tetrad: Actively Secure 4PC for Secure Training and Inference*. † In 29th Network and Distributed System Security Symposium (NDSS'22) (CORE rank- A\*) [Full Version]
- 6. [C] Arpita Patra, Thomas Schneider, Ajith Suresh and Hossein Yalame. SynCirc: Efficient Synthesis of Depth-Optimized Circuits for Secure Computation. In IEEE International Symposium on Hardware Oriented Security and Trust (HOST'21) [Full Version]
- 7. [C] Nishat Koti, Mahak Pancholi, Arpita Patra and Ajith Suresh. SWIFT: Super-fast and Robust Privacy-Preserving Machine Learning.† In 30th USENIX Security Symposium (USENIX'21) (CORE rank- A\*) [Full Version]
- 8. [C] Patra, Thomas Schneider, Ajith Suresh and Hossein Yalame. *ABY2.0: Improved Mixed-Protocol Secure Two-Party Computation*. † In 30th USENIX Security Symposium (USENIX'21) (CORE rank- A\*) [Full Version]
- 9. [C] Arpita Patra and Ajith Suresh. *BLAZE: Blazing Fast Privacy-Preserving Machine Learning*.† In 27th Network and Distributed System Security Symposium (NDSS'20) (CORE rank- A\*) [Full Version]
- 10. [C] Harsh Chaudhari, Rahul Rachuri and Ajith Suresh. *Trident: Efficient 4PC Framework for Privacy Preserving Machine Learning*.† In 27th Network and Distributed System Security Symposium (NDSS'20) (CORE rank- A\*) [Full Version]
- 11. [J] Megha Byali, Harsh Chaudhari, Arpita Patra and Ajith Suresh. *FLASH: Fast and Robust Framework for Privacy-preserving Machine Learning*. In 20th Privacy Enhancing Technologies Symposium (PETS'20) (CORE rank- A) [Full Version]
- 12. [C] Harsh Chaudhari, Ashish Choudhury, Arpita Patra and Ajith Suresh.

  ASTRA: High Throughput 3PC over Rings with Application to Secure Prediction.†‡

  In ACM Conference on Cloud Computing Security Workshop (ACM CCSW'19) [Full Version]

Research work(s) published during M.Tech. (Research). I am the primary author for publications marked with †.

13. [C] Arpita Patra, Pratik Sarkar and Ajith Suresh. Fast Actively Secure OT Extension for Short Secrets. 
In 24th Network and Distributed System Security Symposium (NDSS'17) (CORE rank- A\*) [Full Version]

#### Workshops, Symposiums & Posters

- 1. Andreas Brüggemann, Thomas Schneider, Ajith Suresh and Hossein Yalame. Is Everyone Equally Trustworthy in Practice? (Short Talk). In IEEE S&P'23 (Short Talk)
- 2. Gowri R Chandran, Raine Nieminen, Thomas Schneider and Ajith Suresh. *PrivMail: A Privacy-Preserving Framework for Secure Emails (Short Talk)*. In IEEE S&P'23 (Short Talk)
- 3. Andreas Brüggemann, Thomas Schneider, Ajith Suresh and Hossein Yalame. Efficient Three-Party Shuffling Using Precomputation. In ACM CCS'22 (Poster) [Poster Link]
- 4. Daniel Günther, Marco Holz, Benjamin Judkewitz, Helen Möllering, Benny Pinkas, Thomas Schneider and Ajith Suresh. Privacy-Preserving Epidemiological Modeling on Mobile Graphs.
  In ACM CCS'22 (Poster)[Poster Link] [Full Version]
- 5. Nishat Koti, Shravani Patil, Arpita Patra and Ajith Suresh. *MPClan: Protocol Suite for Privacy-Conscious Computations*. In ACM CCS'22 (Poster) [Poster Link], In NDSS'22 (Poster) [Poster Link]
- 6. Ajith Suresh. MPCLeague: Robust MPC Platform for Privacy-Preserving Machine Learning. In Doctoral Symposium (AIMLSystems'22) [PDF]
- 7. Nishat Koti, Arpita Patra, Rahul Rachuri and Ajith Suresh. *Tetrad: Actively Secure 4PC for Secure Training and Inference*. In PPML'21 (ACM CCS'21) [Full Version]
- 8. Arpita Patra, Thomas Schneider, Ajith Suresh and Hossein Yalame. *ABY2.0: Improved Mixed-Protocol Secure Two-Party Computation*. In PriML'21 (NeurIPS'21), In PPML'21 (ACM CCS'21), In PPML'21 (CRYPTO'21) [Full Version]
- 9. Nishat Koti, Arpita Patra and Ajith Suresh. *MPCLeague: Robust and Efficient Mixed-protocol Framework for 4-party Computation*. In IEEE S&P'21 (Poster), In DPML'21 (ICLR'21) [Poster Link] [PDF]
- 10. Nishat Koti, Mahak Pancholi, Arpita Patra and Ajith Suresh. SWIFT: Super-fast and Robust Privacy-Preserving Machine Learning. In ARCS'22 (Symposium), In DPML'21 (ICLR'21), In PriML/PPML'20 (NeurIPS'20) [Full Version]
- 11. Harsh Chaudhari, Ashish Choudhury, Arpita Patra and Ajith Suresh. ASTRA: High Throughput 3PC over Rings with Application to Secure Prediction. In PPML'19 (ACM CCS'19) [Full Version]

## PREPRINTS & MANUSCRIPTS

- 1. Felix Marx, Thomas Schneider, Ajith Suresh, Tobias Wehrle, Christian Weinert and Hossein Yalame. HyFL: A Hybrid Approach For Private Federated Learning. Under Submission [Full Version]
- 2. Yaniv Ben-Itzhak, Helen Möllering, Benny Pinkas, Thomas Schneider, Ajith Suresh, Oleksandr Tkachenko, Shay Vargaftik, Christian Weinert, Hossein Yalame and Avishay Yanai. *ScionFL: Secure Quantized Aggregation for Federated Learning*. Under Submission [Full Version]
- 3. Daniel Günther, Marco Holz, Benjamin Judkewitz, Helen Möllering, Benny Pinkas, Thomas Schneider and Ajith Suresh. *Privacy-Preserving Epidemiological Modeling on Mobile Graphs*. **Under Submission** [Full Version]
- 4. Vinod Ganapathy, Eikansh Gupta, Arpita Patra, Gokulnath Pillai and Ajith Suresh. *Privadome: Protecting Citizen Privacy from Delivery Drones.* Under Submission [Full Version]

# **Talks and Presentations**

- 1. October 2022. MPCLeague: Robust MPC Platform for Privacy-Preserving Machine Learning. Second International Conference on AI-ML Systems (AIMLSystems'22). Bangalore (Hybrid Event), India.
- 2. April 2022. *Tetrad: Actively Secure 4PC for Secure Training and Inference*. The Network and Distributed System Security Symposium (NDSS) 2022, Hybrid Event.
- 3. August 2021. SWIFT: Super-fast and Robust Privacy-Preserving Machine Learning. 30th USENIX Security Symposium, Virtual Event.
- 4. June 2021. SWIFT: Super-fast and Robust Privacy-Preserving Machine Learning. CNI Networks Seminar Series, Centre for Networked Intelligence, Virtual Event, India.

- 5. May 2021. MPC for small population with applications to Privacy-Preserving Machine Learning. EECS Research Students Symposium 2021, Virtual Event, India.
- 6. May 2021. MPCLeague: Robust and Efficient Mixed-protocol Framework for 4-party Computation. Distributed and Private Machine Learning (DPML), ICLR Workshop 2021, Virtual Event.
- 7. February 2021. ABY2.0: Improved Mixed-Protocol Secure Two-Party Computation. 15th Academic Research and Careers for Students Symposium (ARCS) 2021, Virtual Event, India.
- 8. February 2021. BLAZE: Blazing Fast Privacy-Preserving Machine Learning. 15th Academic Research and Careers for Students Symposium (ARCS) 2021, Virtual Event, India.
- 9. July 2020. MPC MEETS ML: Efficient Privacy Preserving Machine Learning Techniques. EECS Research Students Symposium 2020, Virtual Event, India.
- 10. July 2020. MPC MEETS ML: Efficient Privacy Preserving Machine Learning Techniques. International Symposium on Current Trends in Research and Innovation (ISCTRI'20), Virtual Event, india.
- 11. February 2020. BLAZE: Blazing Fast Privacy-Preserving Machine Learning. The Network and Distributed System Security Symposium (NDSS) 2020, San Diego, USA.
- 12. February 2020. Trident: Efficient 4PC Framework for Privacy Preserving Machine Learning. The Network and Distributed System Security Symposium (NDSS) 2020, San Diego, USA.
- 13. February 2020. ASTRA: High Throughput 3PC over Rings with Application to Secure Prediction. 14th Inter-Research-Institute Student Seminar in Computer Science (IRISS) 2020, IIT Gandhinagar.
- 14. January 2020. MPC MEETS ML: Efficient Privacy Preserving Machine Learning Techniques. Hitachi-IISc Project Review, IISc, India.
- 15. January 2020. MPC MEETS ML: Efficient Privacy Preserving Machine Learning Techniques. Secure Multi-Party Computation: Theory and Practice Workshop, IISc, India.
- 16. November 2019. ASTRA: High Throughput 3PC over Rings with Application to Secure Prediction. TU Darmstadt, Germany.
- 17. March 2019. MPC MEETS ML: High Throughput Secure ML Prediction. Amazon Project Review, IISc, India.
- 18. August 2018. Cryptography Basics. QIP STC on Foundations of Cryptography, IISc, India.
- 19. April 2017. Fast Actively Secure OT Extension for Short Secrets. EECS Symposium, IISc, India.
- 20. February 2017. Fast Actively Secure OT Extension for Short Secrets. The Network and Distributed System Security Symposium (NDSS) 2017, San Diego, USA.
- 21. February 2016. Oblivious Transfer (OT) and OT Extensions. Workshops on Cryptography, organized as a part of Information Security Education and Awareness Project Phase II, IISc.
- 22. February 2016. Two party computation (GMW construction). Workshops on Cryptography, organized as a part of Information Security Education and Awareness Project Phase II, IISc.
- 23. February 2016. Message Authentication Codes. Workshops on Cryptography, organized as a part of Information Security Education and Awareness Project Phase II, IISc.
- 24. January 2016. Efficient Actively Secure Oblivious Transfer Extension. 10th Inter-Research-Institute Student Seminar in Computer Science (IRISS) 2016, Technopark, Trivandrum, Kerala.

# Research Events

MAY 3, 2023

- 1. November 2022. The 29th ACM Conference on Computer and Communications Security (CCS). Los Angeles, U.S.A.
- 2. October 2022. Second International Conference on Al-ML Systems (AIMLSystems'22). Bangalore (Virtual Event), India.
- 3. June 2022. Theory and Practice of Multi-Party Computation Workshop (TPMPC). Aarhus, Denmark.
- 4. April 2022. The Network and Distributed System Security Symposium (NDSS). San Diego (Virtual Event), California.
- 5. August 2021. 8th Heidelberg Laureate Forum. Heidelberg (Virtual Event), Germany.
- 6. August 2021. The 30th USENIX Security Symposium (USENIX) 2021. (Virtual Event).
- 7. May 2021. EECS Research Students Symposium 2021. Indian Institute of Science (IISc), Bangalore (Virtual Event), India.
- 8. May 2021. Distributed and Private Machine Learning (DPML), ICLR Workshop 2021. (Virtual Event).
- 9. February 2021. 15th Academic Research and Careers for Students Symposium (ARCS) 2021. PSG College of Technology, Coimbatore (Virtual Event), India.

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- 10. July 2020. EECS Research Students Symposium 2020. Indian Institute of Science (IISc), Bangalore (Virtual Event), India.
- 11. July 2020. International Symposium on Current Trends in Research and Innovation (ISCTRI'20). CHRIST University, Pune Lavasa Campus (Virtual Event), India.
- 12. February 2020. The 27th Network and Distributed System Security Symposium (NDSS) 2020. San Diego, USA.
- 13. February 2020. 14th Inter-Research-Institute Student Seminar in Computer Science (IRISS) 2020. Indian Institute of Technology (IIT) Gandhinagar, India.
- 14. January 2020. Secure Multi-Party Computation: Theory and Practice 2020. Indian Institute of Science (IISc), Bangalore, India.
- 15. November 2019. The 26th ACM Conference on Computer and Communications Security (CCS) 2019. London, United Kingdom.
- 16. December 2017. 18th International Conference on Cryptology (INDOCRYPT) 2017. The Institute of Mathematical Sciences (IMSc), Chennai, India.
- 17. March 2017. NMI Workshop on Secure Multiparty Computation. Indian Institute of Technology (IIT), Bomaby, India.
- 18. February 2017. The 24th Network and Distributed System Security Symposium (NDSS) 2017. San Diego, USA.
- 19. June 2016. Theory and Practice of Secure Multiparty Computation Workshop (TPMPC) 2016. Aarhus university, Denmark.
- 20. January 2016. 10th Inter-Research-Institute Student Seminar in Computer Science (IRISS) 2016. Trivandrum, India.