

# Natansh Mathur

QUANTUM COMPUTER SCIENCE ENTHUSIAST

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## Summary

A curious computer scientist (in making) searching for concrete questions and their solutions, especially in quantum computer science. Familiar with quantum computing, quantum communications and cryptography, quantum machine learning and optimisation, and fundamentals of computer science. Always open to discussions on mathematics, music, and teas.

## Education

### University of Paris

PARISIAN MASTER OF RESEARCH IN COMPUTER SCIENCE (MPRI)

- Grades: N/A

Paris, France

2021 - Exp. 2022

### Indian Institute of Technology, Roorkee

BACHELOR OF TECHNOLOGY IN COMPUTER SCIENCE AND ENGINEERING

- CGPA: 9.538/10

Roorkee, India

2017 - 2021

### LBS Senior Secondary School, Kota

GRADE 12 (SENIOR SECONDARY LEVEL)

- Percentage: 95.2%

Kota, India

2017

### Nosegay Public School, Sri Ganganagar

GRADE 10 (SECONDARY LEVEL)

- CGPA: 10/10

Sri Ganganagar, India

2015

## Experience

### QC Ware Corp.

RESEARCH ASSISTANT

- Research Assistant under the guidance of Prof. Iordanis Kerenidis.
- Providing QML research consultancy and services to Hoffmann-La Roche.

Paris, France (Remote)

August, 2020 - PRESENT

### IRIF, CNRS and University of Paris

RESEARCH INTERNSHIP

- Research Internship for completion of Bachelor's Thesis Project.
- Guided and supervised by Prof. Iordanis Kerenidis.

Paris, France (Remote)

August, 2020 - December, 2020

### Institute for Quantum Computing, University of Waterloo

UNDERGRADUATE RESEARCH ASSISTANT

- Research Assistant under the guidance of Prof. Norbert Lütkenhaus.
- Associated with Optical Quantum Communication Theory Group.

Waterloo, Canada (Remote)

April, 2020 - July, 2020

### LIP6, CNRS and Sorbonne University

RESEARCH INTERNSHIP

- Summer Research Internship under the guidance of Prof. Elham Kashefi.
- Part of the Quantum Internet Alliance team at CNRS.
- Associated with Paris Centre for Quantum Computing.

Paris, France

May, 2019 - July, 2019

### Information Management Group, IIT Roorkee

CHIEF OF RESEARCH AND DEVELOPMENT

- Working with a team of around 50 tech enthusiasts to develop software solutions for the college campus community.
- Maintain the IIT Roorkee official website with up-to-date technology stack.

Roorkee, India

January, 2018 - June, 2021

## Projects

### Orthogonal Neural Networks

BACHELOR'S THESIS; PART OF RESEARCH AT IRIF AND QC WARE CORP

- Designing an orthogonal neural network architecture inspired by quantum gates.
- Developing strategies to train the perfectly orthogonal neural networks.
- Extending it further to actual quantum architecture and bench-marking the performance.

Paris, France (Remote)

August, 2020 - PRESENT

## Numerical key rate calculator for QKD Protocols

Waterloo, Canada (Remote)

PART OF RESEARCH ASSISTANTSHIP AT IQC, UWaterloo

April, 2020 - July, 2020

- Contributed to the development of the software architecture and wrote protocols fitting into it.
- Wrote unified algorithms to perform parameter optimisation for various QKD Protocols using numerical methods and optimisation techniques.
- Used High Performance super-computing clusters of ComputeCanada to evaluate various QKD protocols' key rates for different parameters.
- Software to be released soon in the public domain.

## Quantum Protocol Zoo

Paris, France

PART OF RESEARCH INTERNSHIP AT LIP6, PARIS

December, 2018 - July, 2019

- Added various protocols to the online encyclopedia of Quantum Internet Protocols and reviewed many others.
- Analysed and identified the resource requirements for performing each of the protocols.
- Developed the 'Knowledge Graphs' - a unified, interactive and user-friendly tool for resource visualisation.
- Available online at [wiki.veriqcloud.fr](https://wiki.veriqcloud.fr).

## Linear Cryptanalysis of Substitution-Permutation Network

Roorkee, India

SUMMER PROJECT

May, 2018 - June, 2018

- Learning project under Prof. Sugata Gangopadhyay, Dept. of CSE, IIT Roorkee.
- Implemented a Substitution-Permutation Network based Block Cipher model.
- Implemented a linear cryptanalytic attack on the developed cryptosystem for retrieval of certain key bits.

## Publications and Posters

### Classical and Quantum Algorithms for Orthogonal Neural Networks

ARXIV PREPRINT

June, 2021

- The preprint is available at <https://arxiv.org/abs/2106.07198>

### Towards an Open-source Software Platform for Numerical Key Rate Calculation of General Quantum Key Distribution Protocols

Amsterdam, Netherlands

POSTER PRESENTED AT QCRYPT, 2020

August, 2020

- The poster is available at <https://2020.qcrypt.net/posters/QCrypt2020Poster139Wang.pdf>

### Quantum Protocol Zoo

Barcelona, Spain

PRESENTED AT QTech, 2020

November, 2020

- The abstract is available at [https://www.premc.org/doc/QTech2020/QTech2020\\_Book\\_Of\\_Abstracts.pdf](https://www.premc.org/doc/QTech2020/QTech2020_Book_Of_Abstracts.pdf)

## Honours & Achievements

- 2021 **USEQIP**, Selected among top 30 individuals from the world by IQC, UWaterloo consecutively twice
- 2020 **USEQIP & URA**, Selected among top 30 individuals from the world by IQC, UWaterloo
- 2017 **Aditya Birla Scholarship Programme**, Shortlisted among 30 students from various IITs for 2017-18 Awards
- 2017 **All India Rank - 348**, JEE Advanced, administered by Indian Institutes of Technology
- 2017 **All India Rank - 231**, JEE Main, taken by more than a million students.
- 2017 **All India Rank - 114**, KVPY, administered by Indian Institute of Science.

## Grants & Fundings

- 2020 **Unitary Fund**, Granted funding for developing open source Quantum Machine Learning teaching material.

## Skills

<b>Programming Languages</b>	Python, C++, MATLAB, Q#, JAVA, C
<b>Packages and Environments</b>	Qiskit, Numpy, IBMQ Experience, Django, Android Studio, SQL
<b>Utilities</b>	Git, Linux Shell, Vim, Jupyter
<b>Relevant Courses (online)</b>	Quantum Information Science, Quantum Cryptography, Quantum Machine Learning (All Audited)
<b>Relevant Courses (offline)</b>	Mathematics-I (Linear Algebra and Calculus), Optimisation Techniques, Quantum Computing, Discrete Structures, Design and Analysis of Algorithms, Theory of Computation, Machine Learning Computational Complexity Theory, Introduction to Probability

## Extracurricular Activity

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### Quantum Computing Group, IIT Roorkee

FOUNDER, CORE MEMBER, SECRETARY FOR THE TERM 2020-21

- Established the Quantum Computing reading group under ACM Student Chapter, IIT Roorkee.
- Conducted QC discussions on various topics from the basics to the advanced.
- Mentored beginners in the field to explore the various topics systematically.

Roorkee, India

2020 - PRESENT

### Geek Gazette

EDITOR AND PRESIDENT FOR THE TERM 2019-20

- Official Tech Magazine based in IIT Roorkee.
- Managed a group of 80 'geeky' people divided into four diversely functional cells - Editorial, Design, Finance and Web.
- Written and edited articles and interviews for 6 issues of the magazine and the *website*.

Roorkee, India

2017 - 2021

### Student Mentorship Programme

MENTOR

- Personally mentored five freshmen from the CS Department.
- Individually guided them through personal and academic problems for the entire year.

Roorkee, India

2019 - 2020

### Dramatics Section, IIT Roorkee

DRAMATIST

- Performed one Stage Play and acted as non cast member for three stage and street plays.

Roorkee, India

2017 - 2018

### Programming and Algorithms Group

PROGRAMMER

- Member of the Competitive Coding club based in IIT Roorkee.

Roorkee, India

2017 - 2018

## References

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### Prof. Iordanis Kerenidis

iordanis.kerenidis@qcware.com

### Prof. Elham Kashefi

ekashefi@gmail.com

### Prof. Norbert Lütkenhaus

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### Prof. Sugata Gangopadhyay

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