

# Rui Yuan

DOCTOR

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**Doctor Specialized in Machine Learning, Optimization and Reinforcement Learning**

## Education

### Meta/Facebook AI & Télécom Paris

Paris, France

PHD IN APPLIED MATHEMATICS

2019 - 2023

- Subject: Stochastic Second Order Methods and Finite Time Analysis of Policy Gradient Methods.
- **CIFRE PhD** at Meta AI & Télécom Paris, supervised by Alessandro Lazaric (Meta AI), Robert M. Gower (Flatiron Institute), François Roueff (Télécom Paris). Graduation on **March 17, 2023**.

### École Polytechnique

Palaiseau, France

MASTER'S DEGREE IN DATA SCIENCE

2017 - 2018

- One of the **best** master programs in artificial intelligence in France.

### École Polytechnique

Palaiseau, France

MASTER OF SCIENCE & ENGINEERING (DIPLOME D'INGÉNIEUR)

2012 - 2015

- Specialized in Applied Mathematics in the **Rank 1** French engineering school.

### Lycée Janson de Sailly

Paris, France

CLASSES PRÉPARATOIRES (EQUIVALENT TO BACHELOR IN MATHEMATICS AND PHYSICS)

2010 - 2012

- Intensive courses of Mathematics, Physics and Computer Science leading to the nationwide highly competitive exam for admission to a graduate-level engineering school ("Grande Ecole")

## Experience

### Meta/Facebook AI & Télécom Paris

Paris, France

PHD RESEARCH ASSISTANT

2019 - 2023

- Developed a fundamental understanding of optimization methods applied in **Reinforcement Learning** (RL) to bridge the gap between theory and practice, achieved **state-of-the-art** convergence analysis, including **deep RL** as special cases.
- Designed new efficient practical **optimization** algorithms to solve **large scale Machine Learning** problems and achieved **state-of-the-art** learning performance, both theoretically and empirically.
- Contributed to the **automated theorem proving** project at Meta AI, resulting in the following publications: 1. HyperTree Proof Search for Neural Theorem Proving; 2. Draft, Sketch, and Prove: Guiding Formal Theorem Provers with Informal Proofs.
- Published **4 first author research papers** in top Machine Learning conferences and journals (**1 ICLR**, **2 AISTATS** and **1 SIAM**).
- Published 1 preprint under review, in which I served as the **senior author** to lead the project.

### African Institute for Mathematical Sciences (AIMS)

Kigali, Rwanda

TEACHING ASSISTANT

2019

- Helped teach **African Master's in Machine Intelligence - Stochastic Optimization for Machine Learning**.

### Télécom Paris

Paris, France

RESEARCH INTERN

2018

- Introduced an optimization algorithm for general large scale machine learning problems, supervised by Robert M. Gower and Olivier Fercoq, which was accepted at the Paris-Saclay Junior Conference on Data Science and Engineering 2018 (**JDSE2018**).

### Kaggle Challenge

Palaiseau, France

FOREST COVER TYPE PREDICTION

2015

- **Results:** Achieved **83% prediction accuracy**; **ranked 22nd** out of 1692 teams (spent two months in the competition and finished **14th** at the time, eight months before the end)
- **Objective:** Use a cartographic dataset to classify forests into 7 categories (11 features, 15120 samples for training and 565892 instances for testing).
- **Work:** First, a specific feature engineering was performed depending on the data; then, applied a combination of **Random Forest** and **Adaboost** algorithm as an estimator using scikit-learn and WEKA.

### IBM

Gentilly, France

COLLECTIVE SCIENTIFIC PROJECT IN COMPUTER SCIENCE - APPLIED MATHEMATICS

2013 - 2014

- **Realization:** Created an **Android application** that classified a user's tweets into twelve themes.
- **Work:** First, data was extracted from Twitter using its APIs and a Java library - Twitter4j; then, textual data was standardized using Snowball; finally, tweets were classified using maximum entropy by a Stanford NLP library.

## Presentations

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### SCIENTIFIC TALKS

- 2022 **A general sample complexity analysis of vanilla policy gradient.** Invited talk at International Conference on Continuous Optimization (**ICCOPT**) at Lehigh University. *Bethlehem, U.S.A*
- 2020 **Sketched Newton-Raphson.** Invited talk at Workshop on Scientific Computing and Optimization at University of Hong Kong. *Online*

### POSTERS

- 2023 **A Novel Framework for Policy Mirror Descent with General Parametrization and Linear Convergence.** 16th European Workshop on Reinforcement Learning (**EWRL 2023**) at Vrije Universiteit Brussel. *Brussels, Belgium*
- 2022 **Linear Convergence of Natural Policy Gradient Methods with Log-Linear Policies.** 15th European Workshop on Reinforcement Learning (**EWRL 2022**) at Politecnico di Milano. *Milan, Italy*
- 2021 **A general sample complexity analysis of vanilla policy gradient.** **ICML 2021** Workshop on “Reinforcement learning theory”. *Online*
- 2021 **SAN: Stochastic Average Newton Algorithm for Minimizing Finite Sums.** 3rd PRAIRIE/MIAI AI summer school (**PAISS**). *Online*
- 2020 **Sketched Newton-Raphson.** **ICML 2020** Workshop on “Beyond first-order methods in ML systems”. *Online*

## Honors & Awards

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- 2021 **Outstanding Reviewer Award at NeurIPS 2021** *Online*
- 2009 **2nd Prize** China National Mathematics Olympiad (CNMO) *Guangdong, China*
- 2008 **2nd Prize** China National Mathematics Olympiad (CNMO) *Guangdong, China*

## Miscellaneous

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- 2020 - 2023 **[Review Services] Reviewer for NeurIPS, ICML, AISTATS, FOCS, SISC, SIMODS, EWRL.**
- 2012 - 2014 **[Volunteering] Executive Committee Member of Binet X-Chine**, responsible for communication and activities of the Chinese Cultural Association of École Polytechnique.
- 2012 - 2014 **[Volunteering] Active member of Binet ASK (Social Action of the KES)**, responsible for helping local college and high school students by collecting books and reading together.
- 2011 - 2012 **[Volunteering] Class Monitor in the French preparatory class.**
- **[Interests]** Accordion: 5 years; Basketball: 11 years; Skiing: 10 years; Badminton: 2 years; Jogging: 2 years.

## Skills and Tools

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- Programming** Python (master - NumPy, PyTorch, scikit-learn, pandas, ...), LEAN, Java, R, Matlab, CAML, SQL, JavaScript, HTML/CSS.
- Tools** Sublime Text (master), Git (master), LaTeX (master), VS Code, macOS, Linux, tmux, Slurm, Apache Hadoop, Hue, Spark.
- Languages** Mandarin (Native), Cantonese (Native), French (Full working proficiency), English (Full working proficiency).

## Publications

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- Carlo Alfano, **Rui Yuan**, Patrick Rebeschini. A Novel Framework for Policy Mirror Descent with General Parametrization and Linear Convergence. Accepted at *European Workshop on Reinforcement Learning (EWRL)*, 2023.
- Rui Yuan**, Simon S. Du, Robert M. Gower, Alessandro Lazaric, Lin Xiao. Linear Convergence of Natural Policy Gradient Methods with Log-Linear Policies. Accepted at *International Conference on Learning Representations (ICLR)*, 2023.
- Rui Yuan**, Robert M. Gower, and Alessandro Lazaric. A general sample complexity analysis of vanilla policy gradient. Accepted at *International Conference on Artificial Intelligence and Statistics (AISTATS)*, 2022.
- Jiabin Chen\*, **Rui Yuan\***, Guillaume Garrigos, Robert M Gower. SAN: Stochastic Average Newton Algorithm for Minimizing Finite Sums. Accepted at *International Conference on Artificial Intelligence and Statistics (AISTATS)*, 2022.  
\*Equal contributions.
- Rui Yuan**, Alessandro Lazaric, and Robert M. Gower. Sketched Newton-Raphson. Accepted at *Society for Industrial and Applied Mathematics (SIAM) Journal on Optimization (SIOPT)*, 2022.