

El Mahdi El Mhamdi

ROBUST DISTRIBUTED LEARNING · ROBUST LEARNING MACHINES

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One Page Summary

December 28, 2019

FACULTY CANDIDACIES

Dear members of search committees,

I am a highly motivated young researcher who wants to build a research group in the robustness of machine learning, distributed systems and their interactions.

My thesis established several results on the robustness of distributed learning and is currently nominated for the EPFL's PhD award. Among the key results of this thesis, I developed the first distributed setting for stochastic gradient descent (SGD) that is resilient to arbitrarily malicious learners (SGD is the workhorse behind today's most successful ML deployments). I did that first in the synchronous context, using similar tools to those from robust statistics, then in the more challenging asynchronous setting, using a novel filtering scheme. On the practical side, my algorithms led not only to more secure, but also to faster deployments of established distributed machine learning frameworks as they made them support lossy communication channels.

During my PhD at EPFL, I was hosted by a distributed computing research group, supervised by Prof. Rachid Guerraoui who gave me the full freedom to establish research directions of my own. In particular, the freedom to start and lead the effort in robust machine learning research in the lab. This resulted in the aforementioned work at the interface between distributed systems and machine learning. Besides my main focus, I also studied other topics in artificial intelligence safety and enjoyed one collaboration with systems biologists and one collaboration with a professor in social sciences. These type of collaborations can only happen thanks to what academic freedom allows.

As an aspiring professor, I plan to pursue research at the interface between distributed systems and machine learning, and to a lesser extent systems biology (where some of my PhD results can be applied). In the short term, I want to expand my PhD work to incorporate recent advances in (high dimensional) robust statistics and decentralized learning to build reliable machine learning algorithms. I am ideally seeking places with an interdisciplinary culture where this research can flourish.

Though a fresh PhD graduate, I have a work experience of four years prior to starting my PhD. My work as a research engineer in physics was published in the Applied Physics Letters, the top venue for applied physics. I also co-founded Mamfakinch, a media which won the *breaking borders award* given by Google and Global Voices in 2012 and Wandida.com, a university-level tutoring project which is now incorporated by EPFL in its online education portfolio. During my PhD, the freedom that I enjoyed from my supervisor allowed me not only to start research directions of my own, but also to mentor and supervise more junior students for whom I designed master thesis or early PhD project topics. I also taught courses (one as a sole instructor, others as a teaching assistant) and wrote the scientific proposals (which were based on my PhD results) of two successful grants for my supervisor, totalling about 1.2 million dollars. Finally, with my co-author Dr Lê Nguyễn Hoàng, we published a book on robust and beneficial AI which is based on our complementary works in social choice theory and distributed learning respectively.

Additional documents are enclosed. Please feel free to contact me if supplemental information is required.

I thank you for your time and consideration and I look forward to hear from you.

Sincerely,

El Mahdi El Mhamdi

Attached: Curriculum Vitae, Research Statement, Teaching Statement