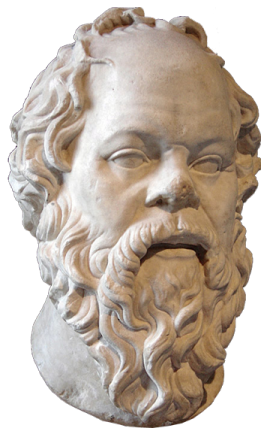


The DPhil Grind



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draft, compiled at September 12, 2024

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Prologue

My journey towards a PhD started back in 2015 when I met Ilya Kostrikov¹ in Aachen during my Master's. He said something like: "Want to do cool stuff? You need to do a PhD!" This encounter changed my life. I started my Master's to learn how to make autonomous cars thinking that you just need to learn some math and programming for that. I had always been fascinated by science, but it had never occurred to me that I could become a part of it. From that point onwards, autonomous cars were postponed², I had to get a PhD first. These three mysterious letters became my obsession. I wanted to do cool stuff, after all!

Around the same time, I stumbled upon 'Ph.D Grind, a Ph.D. student memoir', where Philip Guo, now a professor at UCSD, described his journey towards a PhD³. I read that hundred pages in one sitting, and it was breathtaking. Of

¹<https://twitter.com/ikostrikov>

²Sorry, Elon!

³The author shut down his website and the openly available pdf some time ago, but you can easily find the text on the internet.

course, the book was full of cautionary tales, but I was so fascinated by the world of academia that I did not take those seriously. And I still do not know if I should have.

‘Ph.D Grind’ has one major flaw, though. It is too short, and there are no more books like it. However, as Philip Guo said, his book is only a single data point. It is time for me to add one more. Welcome ‘DPhil⁴ Grind, a DPhil student memoir’!

They say that every DPhil is different. What is so special about mine? And, as a result, what is so special about this book? There are, actually, quite a few things!

- Similarly to the author of ‘Ph.D. Grind’, I did my DPhil in Computer Science. However, my specialisation is different. I work in machine learning, a rapidly expanding compute-hungry field with hundreds of papers making your research obsolete on a daily basis.
- As a consequence of the above, I interned in four big tech companies⁵ during my DPhil, getting experience doing research in industrial labs.
- I did my first undergraduate degree in Economics, which is a bit non-standard for a DPhil in Computer Science.
- I did my DPhil at the University of Oxford, a stunningly

⁴DPhil is a fancy name for the PhD used by the University of Oxford. I will use it instead of a less fancy PhD from now on.

⁵NVIDIA, Facebook AI Research, Microsoft Research, and Google DeepMind.

beautiful town full of traditions. This is a power place for science and as magical as Hogwarts.

- I kept a diary of my experience, writing in it **every day** throughout the four years of my DPhil.
- I am a proud parent of an eight-year old⁶, and while my amazing wife did everything possible to make it easier for me, parenting affected my DPhil experience a lot, making it harder and easier at the same time.
- I did my DPhil in 2018-2022, a turbulent time that includes Brexit, the pandemic⁷, the death of the Queen, and a full-blown war in the heart of Europe with my country being the aggressor.
- At the beginning of my DPhil, fascinated by the whole new world of science, I really wanted to stay in academia. However, after my rose-coloured glasses were gone, I changed my mind along the way (again) and decided to join the industry.
- The less unique thing about my experience is that I struggled a lot and was on the brink of quitting multiple times. I personally know several people who quit. I

⁶This book was written in 2022.

⁷If you read these pages in the far future, and there has been multiple pandemics since then, I mean the COVID pandemic started in 2020.

want to use this book to increase the awareness of mental health issues among postgraduate students, helping others⁸ better understand the students' state of mind.

If, after reading all the above, you still want to keep going, I have a word of warning for you. As a proper old man, I cannot resist the temptation to give highly opinionated advice throughout this book. Remember, this is your DPhil, this is your life. Take all the advice with a grain of salt! Use this book at your own risk!

⁸Parents, friends, professors, university administration, etc.

Pre-Historic Times

In this chapter, I will recount the significant life events that ultimately led me to starting and, also, to successfully finishing my DPhil.

At age five, I started digging a hole in our backyard to get to the Earth's inner core, an early display of my inclination to embark on substantial endeavours without much planning. This is known nowadays as Facebook's motto: 'Move fast and break things', and is a good match with computers that make the cost of an error negligible¹ and feedback immediate². As for the hole, my grandmother told me off for such a mess in the garden and forbade doing anything similarly crazy in the future. Later I found out that someone made more progress on that front with the [Kola Superdeep Borehole](#).

Several years later, another significant encounter with science unfolded when I stumbled upon an article about Fermat's

¹Unless you are a safety-critical system developer.

²Victor Bret has a fantastic [talk](#) on the importance of immediate feedback.

Last Theorem in a Soviet math encyclopedia. Determined to solve this problem as I grew older, little did I realize that the theorem had already been proven, and the book I was reading had been written in the 1980s, predating Andrew Wiles' groundbreaking discovery.

My fascination with computers ignited at the age of 11 when my parents promised to purchase one for me if I successfully completed fifth grade with top grades in all subjects. Before this, I had a brief introduction to Quake II during a visit to my mom's office. Coupled with the release of 'The Matrix' in 1999, it was enough motivation for my mediocre grades to jump to straight fives³ for all subjects.

In anticipation of the day my parents would fulfil their promise, I dedicated myself wholeheartedly. I sought advice from a classmate who owned a PC, meticulously sketching software interfaces in my notepad to prepare for the moment when I would finally have my own computer. Day D finally arrived, and I spent the whole summer of 2002 playing video games.

In 2006, a friend of mine installed Ubuntu on his machine, and I got curious⁴. Trying to impress him with my skills, I found a FreeBSD image and accidentally destroyed all my files. Nobody does backups without losing their data first, right? The sad thing is that I didn't even succeed in installing FreeBSD that day. I surrendered and asked my friend to help

³Russian schools have a five-point grading system with five being the highest.

⁴This was a golden era when you could get a disc with the OS image and stickers to your physical post box.

me with Ubuntu the next day. This was the beginning of an amazing journey that bolstered my interest in computers and led me to Arch Linux⁵ I am currently writing these lines on.

Nevertheless, when it was time to choose the profession, assertive parents and booming capitalism in Russia in the 1990s somewhat convinced me that I wanted to become an economist. This is how I ended up in the Moscow State Institute of International Relations, a renowned institution known for educating the offspring of Russian statesmen. Luckily for me, I was part of an experimental group studying mathematical modelling for economics, and this group consisted of nerds, gamers and other weirdos that made my undergrad time truly exceptional. The main two things I achieved during my undergrad were getting to learn English⁶, and meeting my future wife⁷.

I think I was the only person at the university who was using a Linux machine as a daily driver, but I did not think of any possible career related to tech or science. My dream, similar to the ones of my peers, was to get to BCG or McKinsey and become a management consultant. I was not that cool to get to BCG or McKinsey, but I landed an internship at Ernst&Young (EY) at the end of my last year, having a blast

⁵I use Arch Linux, btw.

⁶The university provided amazing possibilities for learning languages. There were two compulsory ones (English and French for me), and you could take as many extras as you want (I studied Chinese).

⁷She randomly sat next to me on the first day, and it was the love at first sight (for me). It took me another year+ to get her interested in me.

at the interviews, when one of the interviewers asked exactly the same question as the previous one. I seized the opportunity and provided a stellar response, ultimately nailing the interview and paving the way for my future career.

I spent the next half a year drawing slides 24/7 and having some kind of existential crisis at the end of my undergrad having no idea about what I wanted to do next. I tried to think of what I liked, and it was math and computers. I decided to do another undergrad to have a more holistic picture of mathematics and went to the Moscow State University to study at the Department of Computational Mathematics and Cybernetics. When I was applying, they told me that they hadn't seen anyone from the Moscow Institute of International Relations before, I thought I made the right call.

This was a moment of personal growth for me as well when I decided to do what I wanted, not what my parents wanted me to do. This resulted in a huge quarrel in the family when I went on to live with my friends and had almost zero contact with my family. But let's not get ahead of ourselves.

My second undergrad time was amazing. I did not care about my grades as much as I did during the first. I was just learning whatever I liked and was discovering an amazing new world for myself. I was not super interested in programming during the first half a year until I learnt that you can pass arguments by value and by reference in Pascal⁸. This was when I got hooked on programming and got determined to find a job as a software engineer.

⁸This sounds a bit quirky, but I remember being amazed by how well everything was thought through.

I remember my first coding interview really well when I was asked to remove the content of an HTML page within `` tags, and I wrote a solution in Pascal, the only language I knew. The interviewer was puzzled but promised to hire me if I came home and rewrote the interview problem solutions in Python. I never went back to that guy, but asked my friend who had a web studio, if they needed any programmers ready to work almost for free while studying and getting more experience in the exchange. Luckily for me⁹, he said yes, and this is how I got my first programming job.

My first year, as a software engineer was super intense. I was coding during the day, and studied during the night trying the stuff I learned overnight the next day on the real project. Unfortunately for my health and personal relationships, I pulled a lot of all-nighters and often had other gigs on the side writing Android apps as a freelancer. The pinnacle of my software engineering career was leading a project where we rewrote an old warehouse management system written in FoxPro making it a nice modern web app that was easy to extend, fast enough to work without causing rage in the users, and doing some linear programming under the hood to do allocations. This was challenging, fun, and one of the first experiences that made me appreciate pragmatism: making something work is all that matters. No matter how ingenious your idea seems on paper, the problem is not solved, until you've tried your solution and checked that it works. Also, these couple of years made me appreciate fast iteration on problems that matter.

⁹Thanks Kostya!

Year 2014 was a special year for me and my wife, that summer, our son was born. It was scary, exciting, and exhausting at the same time. I grew up without a father, and I had to learn how to be a good one, no pressure. At the same time, my relationship with my parents recuperated, which was really nice.

At some point in 2014, I realised that in my daily job, I was not using much of the math I had learnt, and loved so much. I decided, that working on autonomous driving would involve some math, and would be interesting and useful at the same time. I applied to some universities in Germany¹⁰, and got accepted to the University of Saarland and RWTH Aachen which had a mutual program with the University of Bonn¹¹.

I selected RTWH Aachen because I thought that their Computer Vision lab led by Bastian Leibe was the closest I could get to autonomous cars. We moved to Germany with three suitcases, and our new life began.

I had a month before the start of my studies to do all the admin and acclimatize. I decided to get a job in Leibe's lab. Germany has an amazing practice of HiWi, student assistants that get attached to a PhD students and help them out even before doing a master's project with them. I emailed Lucas Beyer, and he invited me to come over.

I don't already remember what we chatted about, but he gave me some version of FizzBuzz and got interested in my

¹⁰Germany sounded cool since education is almost free there, and it would be nice to live in a different country for a while.

¹¹The first year was mostly in Bonn, and we were supposed to move to Aachen in the second year.

x230 laptop that had Arch installed. That won him over, he was an avid Arch user and also used a tiling window manager I was a fan of. I got the job, a machine with a GPU, and a place in the lab. I was hyped!

Surprisingly for me, my master's program allowed students to choose their own curriculum, which was not the case at all for my undergrad. There were some compulsory courses during the first year, but I didn't pay too much attention to them, because I wanted to focus on machine learning. The only non-machine learning course I remember well is 'High-Performance Matrix Computations' taught by Paolo Bientinesi¹². The lectures were captivating, I loved the topic, and I absolutely loved the book by Golub and Van Loan¹³

Let's get back to machine learning. In my first *Advanced Machine Learning* lecture, I found out, that there was a Deep Learning revolution going on, and people doing classical machine learning were being pissed by a bunch of researchers stacking more and more layers on a weekly basis. I thought it was cool enough for me.

I never thought of this at the time, but there have always been people around me who significantly affected my life trajectory. In Aachen, there were two of them: Ilya Kostrikov and Lucas Beyer, and it was Lucas who introduced me to Ilya. We first met at GCPR 2015 which was conveniently located in RWTH, so, I just had to walk from my lab to another building to attend. I clearly remember that I understood almost noth-

¹²<https://yobibyte.github.io/cholesky.html>

¹³https://www.google.co.uk/books/edition/Matrix_Computations/ml0a7wPX60YC?hl=en&gbpv=0.

ing at the talks, and was amazed by people nodding around me, which added to my already strong impostor syndrome.

When I met Ilya at the poster session, having enough common cultural context allowed us to start talking about important stuff straight away: ‘What is your plan? What do you want to do in life?’ And, as I mentioned in the Prologue, he said: ‘Want to do cool stuff? You need to do a PhD’. My life was turned around one more time, and now I had a clear goal in mind: get to a good PhD program.

This made things much harder for me. One of my idiosyncrasies is that I don’t usually like following the predefined curriculum. Instead of following recommended literature with DFS, I do BFS with some random combination of books, YouTube videos and Wikipedia abyss. This makes me a better generalist¹⁴, but often I miss some important bits that people consider a must-know. Getting good grades for the Master’s required following the curriculum, and I felt like a part of me died, but the final goal was more important to me than being authentic or something like that¹⁵.

Ilya became something like an informal mentor to me: he helped me to grasp some machine learning concepts, sent me papers, gave me advice on how to implement stuff and get more visibility on GitHub, constantly nagged me that I should apply and get a Google internship that would boost my career. All of it was extremely helpful for me, and now I realise how

¹⁴People who worked with me might have a different opinion here, but come on, this is my book, I’ll do what I want.

¹⁵Big mistake.

lucky I was¹⁶.

The first question I got when I came to work in the lab was ‘What is your favourite beer?’. I wasn’t quite sure what exactly was happening, but it was nine in the morning, and I was not used to drinking that early¹⁷. It turned out that every computer in the lab was named after their user’s favourite beer and they were making an account for me. I liked that a lot. I also enjoyed having access to a machine with a GPU, though I had never trained a neural network on a GPU before.

My first project was to refactor Lucas’s code that was doing head orientation prediction¹⁸ so that it runs on ROS, the Robot Operating System. I had to learn quite a lot of stuff, ROS was quite a shocker, and I don’t really want to write about it, but Theano was something even more shockier. I thought people were pulling my leg by saying that I couldn’t just simply print out the variable values in Theano. As print statements was my favourite debugging strategy at the time, my productivity decreased by a hundred-fold. But I liked tinkering, and having access to Lucas was amazing as he knew a lot of stuff I didn’t.

Another task of mine was to do data labelling, which I hated a lot.¹⁹ There were two things I understood back then. First,

¹⁶I warned you that I’ll give some advice along the way. Here you go. Find someone more experienced and learn from them. It should not necessarily be an official mentor-mentee relationship. Just ask people questions and don’t be afraid to look stupid or something.

¹⁷For completeness, my favourite beer is Kriek.

¹⁸<https://github.com/lucasb-eyer/BiternionNet>

¹⁹To Lucas’ credit, he didn’t make me do all the data labeling. He

data labelling is hard, and you have to invest your money or time into it to ensure the success of your learning pipeline. It is tedious and time-consuming, and you have to visualise every step of your pipeline to make sure that nothing went wrong along the way, and that your models get what you expect them to. Second, to make the previous one possible, you need to build a convenient infrastructure and use the best tools for the job. Even a simple image viewer program can make a difference²⁰. I think this experience taught me important lessons that affect my everyday decisions at work even now.

Apart from the actual skills I developed when working with Lucas, I also got a glimpse of the lives of the lab's PhD students. On the one hand, there was this amazing atmosphere of collaboration, people having fun and enjoying solving interesting challenges. There was an fabulous expectation of incoming changes with Deep Learning eating the computer vision field step by step. However, I could sense some people were stressed, or even depressed, sometimes, they looked desperate crushed by negative reviews or by being stuck for a long period of time. This was also when I read the 'PhD Grind' by Philip Guo which also described how hard a graduate student's life can be. Surprisingly in retrospect, I didn't think of this seriously enough, and none of these sad experiences actually affected my decision to become a graduate student myself.

* * *

equally split it between us two, and I appreciated this a lot.
²⁰I will be forever grateful to the creators of [Geeqie](#).

It's not every day that you read a scientific paper and it changes the course of your whole life. The Arxiv version of the DQN paper²¹ was one of these rare cases for me.²² And, of course, it was Ilya who sent me that paper.

This paper had everything: video games, source code that you could download and play with²³, it was easy to understand on a high level and the product was visual. I loved every bit of it.

Ilya trained a Pong agent on the Uni machine, and it looked like magic²⁴. It was pretty clear what I was going to work on for my master's thesis.

I came up with the idea of cold-emailing other professors and industry researchers trying to find collaborators outside of my lab. I didn't think of that back then, but I now believe this was a genius idea. Nobody constrains you to work with your Uni professors only, getting out there will expose you to different problems, ideas, and other working styles, and will increase your network. And you might have some fun along the way as well! Most of my emails were not being replied to, but there was one that came back from Sebastian Nowozin, another hero of this book who altered my life trajectory.

Sebastian was at MSR, Cambridge back then, and his website said that he was looking for student collaborators in academia. He probably meant 'PhD student collaborators', but I decided

²¹<https://arxiv.org/abs/1312.5602>

²²There is another one like that, but you'll need to read further couple of chapters to learn which paper was that.

²³Lua was pretty terrible though.

²⁴Though it was a rather slow magic.

to ignore this thought and shot him an email. I couldn't find the exact email, but it was something along the lines: *I'm Vitaly. I'm planning to do a PhD in a year, and, to prepare for that, I'd like to do a master's thesis in RL. I have been using Linux for 10 years, and I can code in Python or Java. Could you, please, be my co-supervisor?* To my great surprise and delight, Sebastian replied the next morning (which was mind-blowing given that I sent an email about 2am at night²⁵). We had a couple of meetings and devised a plan: I write a website with an Atari emulator²⁶, collect human trajectories for five games and do imitation learning on top. GAIL paper appeared at that time (<https://arxiv.org/abs/1606.03476>), and imitation learning was on the rise. Imitation learning look exciting to me and made a lot of sense given my experience with training a Pong agent for a week.

What was even more exciting, according to the plan, I was supposed to spend three months at MSR, Cambridge as a visitor, working on the second part of the project: training models on the collected data. Cambridge had been the place of my dreams after I spent two weeks there back in 2010. Every history of science book I read mentioned it at some point, and it was a place of power for me from this perspective as well²⁷.

²⁵Maybe this was partially because my email got on top of the list? People use this to hack Arxiv submission timings.

²⁶No, I didn't write an emulator. There was a good emulator written in JS already, I had to do the scaffolding and attract people on the website to get the data. I had a plan B as well: if nobody wants to play, I'll just spend a week of gaming and get all the data I need.

²⁷Now after I've graduated from the other place, I realised that

So, when I got a document from MSR inviting me to come over and spend three months, I felt like Harry Potter who got a letter from Hogwarts.

It was time to get my hands dirty and do some web development. It doesn't sound too sexy, but I love programming, and it was a well-scoped project that I could finish within a reasonable amount of time: it was perfect! Getting users to play on the website was the hardest bit. I had some experience of guerilla marketing from my undergrad, but it was still hard when you are nobody and your social media presence is non-existent. 'Play for science' was a nice perk though, and I had a lot of friends ready to do that²⁸.

I also had some fun maintaining the server the whole thing was running on. I remember ssh'ing from my phone trying to revive the server while taking a sleeping car to my grandma's house. It was quite stressful since it coincided with me posting stuff on Reddit and I was stressing about losing some super important trajectories²⁹.

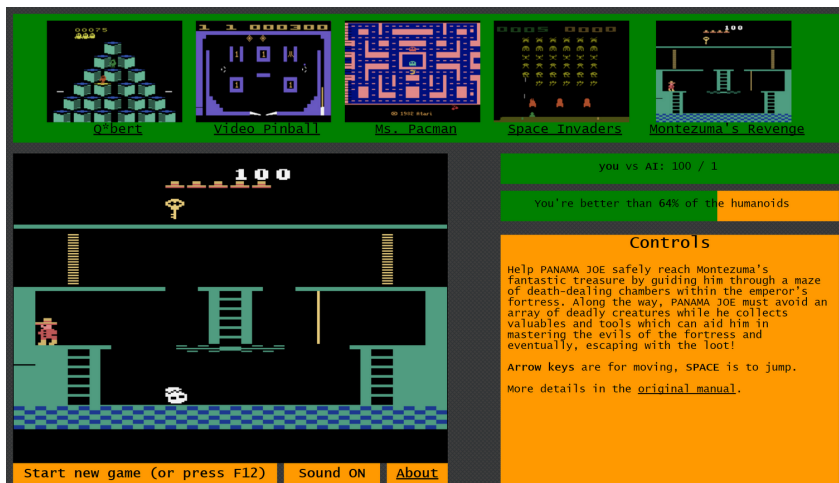
* * *

I am standing at King's Cross and my taxi driver is cramming my son's pram into a front seat on the left. I ask him,

Cambridge is not that cool. JK, Cambridge is amazing.

²⁸Huge thanks to Valentin Belonogov who kept beating his Montezuma's Revenge top score and was almost a sole contributor to later stages of that game.

²⁹As usual, the importance of the events appears to be higher when you are at that moment. I should have probably stressed less and having more fun, but I couldn't back then.



Interface of my human trajectories collection website.

where is he gonna sit now. He looks at me as if I am crazy, as, obviously, drivers sit on the right here. My UK experience begins.

For the first several days I feel great. MSR has a beautiful office with a grand piano in the main hall, someone is playing Chopin's Ballade No.1 in G minor. This becomes my soundtrack for the next three months. People around are extremely friendly and ready to help. I can speak to anyone and lunch conversations are amazingly absorbing.

But in a couple of days, there comes a problem. My old friend, impostor syndrome, smashes me really hard. Every time someone calls me an expert in Reinforcement Learning asking for advice, I am having a hard time and feeling I am a crook. My ideas do not work out and nothing really works that

well, I am under constant stress. This makes me stay at the office late, sometimes returning home after 10pm. Obviously, this does not lead to any creative breakthrough, and I'm in panic mode. Even now, when I write these lines, my heartbeat goes up and I feel uneasy. I was having a hard time there, mostly because of too high expectations of myself there, which didn't do me any good.

Though it was harsh, there were lots of good moments and opportunities there³⁰. I could speak to people whose papers I read before. I made several good friends there and spoke to the interns who were doing their PhDs at the time in research labs across the world. I was learning how to do research in an amazing environment, and failing was a part of it.

Finally, all my conversation with Sebastian was like speaking to a prophet who knows stuff other people don't. Some people are super smart, and some people are the next level after that. Sebastian is one of these people. Every time we met, he said something that blew my mind. Apart from knowing what was happening in the community, Sebastian knew very well what was happening in the industry, he thought a lot about the future of the field, and where everything was going, and I loved it a lot.

* * *

By the end of my time at MSR, I found a job ad on the RL mailing list³¹. The job ad was from a new Oxford startup

³⁰I now have Bishop's textbook signed by Chris Bishop.

³¹I feel like a real boomer now. Yes I used DL and RL mailing lists extensively back in 2017/2018.

called Morpheus Labs which was looking for people doing RL and imitation learning. It was an amazing fit for me! The coolest story about the process there is that I missed my first interview because Google Calendar had messed up the time zone, and I really wanted to get ice cream before the interview. I hardly remember being so angry at myself that much before that. Luckily, they were nice to me and my interview got rescheduled.

At that time, I was also not sure what to do after my Masters. PhD and all the science stuff I wrote above sounded nice, but having an offer with real money sounded too good to refuse. However, I was still on the fence and decided to try getting an offer at the Max Planck Institute in Tuebingen. The process itself was amazing. The organisers made it look like a workshop which was colocated with the MLSS that year. We all listened to each others' research talks, made a lot of new friends, had access to professors during lunch breaks, and had our hotels paid for. It was the best University interview experience I had ever had.

However, I was still not sure what to do. I liked Tuebingen a lot, I liked many people who were doing their PhDs there, and I liked the professors I spoke to³². At the same time, living in Oxford for a year sounded really attractive, getting a salary was attractive too, and the stuff I could do in a startup was also something I wanted to do. I decided to give it a shot and move to Oxford for a year and start my PhD after that, at least I thought I would.

³²Georg Martius is one of the smartest and nicest person I spoke to there.

It was time to hand in my thesis and move to the UK. This was a hectic period full of admin stuff, looking for a flat in Oxford (which is a huge quest on its own), moving a lot of stuff, and visiting MLSS in Madrid in the meantime.

It was the end of September 2017, I was sitting on a pile of stuff in my new flat, looking at raindrops on the window pane. I was totally oblivious to what would happen to me, but I loved my new place. I don't know why I liked it, still really don't know why I like it, but that's the way it works in the UK.

* * *

The end of 2017, and the first half of 2018 were my Oxford honeymoon. I made some friends, the city was incredibly beautiful, and had an aura of scientific history that made me feel great. Living there was also an incredible opportunity to have access to talks and reading groups happening around.³³

For me, it was also a great time, because my impostor syndrome went away a bit. I did not make any scientific breakthroughs during my time at Morpheus Labs, but it was daily little things that changed my attitude towards myself. People asked me questions I knew the answers to, my Linux experience was immensely useful, and I felt amazing. I felt much better than during my Masters, when the progress was hard to measure, and, the scope was more vague.

³³It would be much easier with a University card to get access to those, but tailgating and friends with access cards was good enough!

Morpheus Labs also gave me incredible startup experience. I think, when I joined the team, there were about five people in there. There was no bureaucracy, all the tech decisions were made really fast, and there was a lot of agency in there. This was fabulous!

I also made good friends in Oxford. Kiko and Joao became ‘life trajectory changing’ people I mentioned at the beginning of this chapter. I learnt a lot from them on the technical side, and we had fun working together, but, what is more important to me, we became more than colleagues. Looking back, I have been to a bunch of organisations where people just work together, and I did not have a great time there. Morpheus Labs was different, I found support there, and music jamming sessions with Kiko were incredibly valuable to me.

Several months after I had started working at Morpheus Labs³⁴, I remembered that I still wanted to a PhD, and being in proximity to one of the best universities in the world, I applied to Oxford. To be honest, at first, I applied mostly for a laugh. My impostor syndrome returned, and I did not really believe that with my background, I could get in.

Luckily I was wrong! The letter from Hogwarts arrived in due time, and I was incredibly happy for a bit until I realised that I got the place, but did not get any funding. And this was a lot of money, especially when you live without a salary. There comes the last ‘life trajectory changing’ person, Wendy, my future DPhil program administrator, who got me the UK level funding and a bursary, which was hugely helpful in my

³⁴It was later renamed to Latent Logic, and bought by Waymo afterwards, but I’ll stick to the original name.

situation³⁵. Of course, it wasn't an ideal scenario, but for me, it looked like a once-in-a-lifetime opportunity that I should take with no questions asked³⁶. At that time, to be honest, my plan wasn't that well thought-through, the idea was to get more funding while I get in the University³⁷, do as many internships as possible³⁸, and get help from my parents, and personal savings³⁹.

* * *

Before we move to the outro section of this chapter, I would like to write a couple of paragraphs about a tool that not only sparked my interest in computers but has been propelling my studies and developer experience throughout my whole career: Linux⁴⁰. If you could take one piece of advice from this book, let it be this one: 'Linux is an amazing tool, give it a shot!'

Apart from being more productive when working under Linux⁴¹,

³⁵In the UK, there are different tuition fee levels for UK/EU citizens and the others, overseas students. If you are an overseas student, you have to pay three times as much for your tuition.

³⁶In retrospect, it is not so obvious if I made the correct decision, but it is hard to know what would have happened otherwise.
No complaints here.

³⁷Bad idea.

³⁸Worked out well for me.

³⁹I didn't know that at the time, but my Morpheus Labs option grant would help me a lot really soon.

⁴⁰I'm pretty much on board with GNU/Linux terminology, and I have utmost respect for RMS, but I will use Linux in the text for simplicity.

⁴¹If you ask me how I connect to an external projector, you are not my friend anymore.

I simply enjoy using it. Every time I'm trying to switch to a MacBook to get a nice screen, long battery life or not being scared of connecting to an external projector, I miss it and get back to Arch with my next laptop. Why do I love it so much? There are many answers to this question. Partly, it is because I have a feeling of being in control of my own machine. It is also somewhat similar to showing a middle finger to organisations who impose control over you buying some of your freedoms with convenience and network effect. I am not ready to fully jump on the free software train, but I am doing my best.

Another reason is the feeling of being involved in a long journey where a whole bunch of amazing people have built tools making them open, free and fun to use. It is like keeping 'Experience' by Prodigy on repeat and being inside of the 'Hackers' movie⁴². This feeling of understanding something really deeply, building stuff based on this understanding, and having fun along the way are what computers are usually associated with for me, and Linux boosts this feeling 100x.

I am usually very nosy about the way other people work, and which tools they use. If you are one of these people too, to conclude, below, I list the tools I find indispensable in my daily work. I am a 'I use Arch, btw' person. It's the best distro with an amazing community and a great wiki. It is also super minimal, and `pacman` is the best package manager. `i3` is the best window manager I have ever used. It is a tiling window manager that is highly configurable, minimal, has no

⁴²Yes, it's cheesy, but I love it.

visual effects junk, and, as a result, is blazingly fast.

`tmux` is a terminal multiplexer of my choice. It allows you to keep programs running on a remote server even when your connection breaks. Also gives you the ability to run multiple terminal emulators within the same ssh connection. It's so good, that I also use it locally.

`vim` is my default text editor. I'm not a vim ninja that knows every key combination and every command, nor I can do some sophisticated refactoring that is easily done via modern IDEs. But with vim, I can use the same interface locally and via ssh without any sophisticated setup, it is fast and I can reduce mouse clicking which I really hate. There are some alternatives, e.g. `emacs`, but they are objectively worse. I recently switched to `neovim` and am very happy about it.

I haven't been using `PyCharm` much recently, but this is the best IDE I have ever used. Huge shoutout to the guys who build it.

`ag-silversearcher` is an amazing tool to search for anything in your code. I also use some other common utils like `ssh`, `grep`, `tree` etc.⁴³

⁴³To be updated...

Year One: Happiness

It is the end of September, 2018. I am sitting at the Examination school hall excited about what lies ahead of me. My DPhil has officially started. I am a part of the AIMS CDT 2018 cohort, a DPhil program which brings UK DPhils closer to their US counterparts, by including the coursework. One great thing about CDT, is that you start with a cohort of ten-fifteen people, and you can have some potential friends for your DPhil and after. It is not only your labmates you can hang out with. For us it means fourteen one-week courses, and two research mini-projects at any lab at the Computer Science of Engineering Science department before you decide on which lab to join. It makes it total four years instead of default three-year research programs, and, what is more crucial for me, thanks to AIMS program administrator Wendy, I got funding there. I received the default Computer Science department offer as well, but I did not get any funding for that one. The joke is on them!

I was extremely lucky to have met two great people in my

Compeletely
useless, felt
like a
monkey
copy-pasting
code/math
from the
slides/solvers
documenta-
tion.

cohort: Panos and Alessandro. We are a bit running ahead of a train, but I think I would have quit my DPhil if it is not for these two. Going through all the courses together and having the same existential questions, i.e. what mini-projects to work on, with whom, and which lab to join, is a tremendous bonding experience, and gives you a lot of material to complain to each other when having lunch.

Everything
is a complete
chaos.

Before I move on, I should say a couple of words about Wendy. She was absolutely fantastic and helped us in everything, I have never had such an amazing support from university administration before. She fought for our funding, booked us tickets, did everything she could so that we could focus on our studies and research. She is also an amazingly fun person to spend your time with. I am absolutely certain, that without Wendy, AIMS CDT would have been much less successful. If you ever apply to AIMS, speak to her before!

October 1st, 2018 marks the first entry to my DPhil diary, which I kept until the very last date of my DPhil, when I submitted my thesis. I got this idea after reading the PhD Grind, and planned this very book from the very beginning, and it was hard work! There were days, especially closer to the end of my DPhil, when I hated that diary and could barely make myself write something there, but, luckily, I persevered and never skipped a day! It is a living document to the whole thing, and it is so intimate, that I am afraid someone gets their hands on it, because it will be very awkward. Though I think, I will put a couple of quotes from it as margin notes to spice this book up. Bronstein's 'Geometric Deep Learning' and Knuth's 'Concrete Math' have fabulous margin notes, and

Felt like shit
again...

I will continue this amazing tradition.

* * *

One peculiar thing about Oxford is that it is a collegial university. When you join as a student, you join the department and also one of thirty-six colleges. Each college has their grounds, usually hidden behind a high and very old wall, a library, a church, and a canteen, usually called a hall. For undergraduate students, college provides tutors helping them learn the subjects they read from the department.

Each college has a junior common room (JCR), a middle common room (MCR), and a senior common room (SCR). This is an actual room (or two) where anyone of your peers (MCR is for grad students) can go and have a coffee, a game of chess or chat about the latest episode of Love Island. This actually sounds pretty cool as you usually hang out with people like you in the department (or most likely only your lab). In the MCR, you can chat to people from all over the university: a doctor, a historian, or an entomologist who studies the mating behaviour of dung beetles. This is not only just interesting, but widens your horizon by quite a bit, and makes Oxford experience a bit more magical.

Due to a random encounter on a train, I applied for Magdalen College, which is one of the oldest and richest Oxford colleges. It is so rich that it has an actual deer pack wandering inside its walls. It has punts to use at summertime, lots of space to take a stroll, and a great library that works 24/7. It has a magnificent dining hall that serves as a canteen, but

Some of the people like to show their knowledge and asking questions just to show that they know the answer already.

I had my complex analysis course, but I've really forgot almost all of it.

also organises formal dinners where you are expected to wear a gown and pretend as if you are in the Harry Potter movie. Students usually go to each other colleges for those, and often you also have exchange dinners with other colleges to add a bit of variety. I spent a lot of time at my college right after the start¹, but eventually the intensity went down due to my family life, worsening mental state, and, eventually, lockdown, and moving to London.

* * *

Let's chat about the courses. Back then, I looked at all the courses as a distraction from research, but now I actually think they are a brilliant thing. Obviously, it is hard to learn anything within a week, especially if you are new to the topic, but if you treat it as a high-level overview of what is out there with access to all the professors, you can benefit a lot from being at a CDT. So, if you are deciding between a traditional DPhil and a CDT one, I highly recommend doing CDT, especially if it is AIMS.

Obviously, it is impossible to learn anything during a weekly course. It is more like a shopwindow to peek into to understand what is out there. The courses you are familiar with are just for fun, you go there, you speak to the professors and tutors to satisfy your curiosity, and you move on. The courses you are unfamiliar with, are impenetrable, you will have hard time if you want to take them seriously and learn stuff. Control

¹I am proud to have been an almost unbeatable MCR foosball player.

Theory course was like that for me. A couple of courses were organised like hackathons: you get a team, you get a task and you are supposed to solve it within a week.

Some of the tutorials were fun. One of them was on wireless security, where we had to collect enough packets to crack a WiFi password. I remember doing that during my first year during undergrad, which seemed like doing top-secret CIA shit back then. I also loved the reinforcement learning tutorials as this is where my research interests were, and I understood the material.

Tutorials led by senior DPhil students are another great opportunity to understand what's going on in other labs and meet cool people. I was lucky to meet Henry Kenlay who started at AIMS one year before me, and was working on graph nets with Xiaowen Dong. We first met at Signal Processing course tutorials, when he recognised *yobibyte*'s profile picture, the head of Socrates'. He was super reserved and humble, but he knew a lot, and I learned a lot from him throughout my DPhil. We did not interact much during our first year, but in the next few chapters I will write more about him.

Regardless the course content, the most important thing for me I took away from these courses was getting friends. We often stayed till late with Alessandro and Panos to finish the home assignments with an optional pub after. We got together on the common grounds of ranting. This would continue throughout our DPhils: we would often meet together for lunches and walks, and infinitely rant about our lives, supervisors, reviewers etc. I highly suggest you find someone to rant with during your PhD. This has an incredible

Had a seminar on intellectual property in Oxford, time wasted.



Famous hackathon prize.

healing effect on your soul.

One of the best stories from the first year I have is how we won the robotics course hackathon. Given the fact that we spent more than half of the time charging the batteries and fixing some weird connectivity bugs, this is quite an achievement. Later I found out from my friends doing robotics, that fixing your robot most of the time is the norm. In this hackathon, we got a wheeled robot that had to autonomously avoid some obstacles and reach the goal, turn around, and come back to the starting position. Our obstacle detector was shit, and at the last moment, we simply decided to get a penalty for the obstacle by just driving forward, and then reversing instead of rotating the thing. This happily coincided with the fact that the best team's robot got confused by another guy's

red jumper and started following him. GG. You can see the famous 3D-printed prize on the picture below.

* * *

Another cool thing about AIMS CDT is that there are multiple similar doctoral programs in the UK, and once a year all the students from these programs meet in one of the host university for a couple of days of talks and drinking games. Year 2019 was Edinburg's turn, and it was amazing.

Sadly, I was not aware of Edinburg's rough weather, and decided to go only with a laptop bag, and without much clothes. Onebagging gave me some bragging rights, but, in general, it was a big mistake! Edinburgh in May is freaking cold and wet, and you get even colder, when you are wet and strong wind is blowing at you. Apart from that, it was one of the highlights of the year. Edinburgh is an incredibly beautiful city. It is multilayered as a perceptron: you might be standing on one street, and have another whole street above you.

I gave a tutorial on Graph Nets there, we wandered around the city, got drunk, went to listen to some music, and had haggis. If you have not tried haggis yet, believe me, it tastes much better than it looks.

* * *

Not everything was rainbow and unicorns. Occasionally, when chatting to people, I heard stories about supervisors who dissapeared for a year and did not respond to any of students' emails, about people stealing each other ideas, about people

People work really hard, some of them stay till late. I wonder if they can keep the same pace afterwards.

suffering from depression and some of them quitting. First, you listen to these stories as to something alien, but gradually, you get soaked with the atmosphere of hopelessness. Sometimes, when you speak to third-year DPhil students, you speak to the hollow bodies who have the thousand-yard stare², and they want this to be over as soon as possible.

One moment I remember quite well was when we took a lift down after class with our teaching assistant who was a DPhil student in the neighboring lab. No small talk, he told us that he does not want to do his DPhil anymore, that he wants to quit and become a tennis coach or something. This sounded so weird to me back then, but it all makes sense now.

When you speak to professors about stuff like that, they admit it can be hard but has to be treated as a rite of passage. I do not think people are entirely honest about what is going on in their lives when they speak to professors, and professors have their own problems, they do not usually ask. Naturally, as a consequence, people drink a lot. Pubs, subsidised college bars and wine at college formals help you forget about the next conference deadline, your impostor syndrome and serve a good facilitator of honest conversations with your peers. Few people think that this does actually hurt, messes up your sleep, physical, and as a result, mental health. I definitely drank more than I would like to admit to everyone, including myself.

* * *

The first year of my DPhil was a big hit on my health.

²https://en.wikipedia.org/wiki/Thousand-yard_stare

Lack of sleep, physical exercise, stress and alcohol made it harder for me to do research, but it was hard for me to change anything, and I just simply kept going. Later in my first year, I started running, and this helped a lot. I got a Garmin watch and started a 10k program with 3 or 4 runs a week. It felt amazing, and gave me energy.

Sticking to the routine is another great thing. I remember feeling amazing about myself when I went home for a run after a full day of work, took a shower, and got back to the office to finish and send the ICLR draft.

* * *

I do not know if I mentioned, but from the very beginning, my original plan was to stay in academia after I graduate. I liked the general appeal of science, I liked the freedom, I liked the romanticism of it, or, at least, I loved my naive mental model of science I had from reading "Surely You're Joking, Mr. Feynman!" and watching the Big Bang Theory.

If you want to stay in academia, prepare for a financial hit.

In order to get a position, you need to get some teaching experience, and I, actually, love teaching. So, I decided to start from the very beginning, which was, likely, a mistake. One advice for your first year is not to put too much on your plate from the very beginning, when you are still unsure how busy you will be, and how you will cope under constant pressure. Take it easy, there will be lots of opportunities to take on more responsibility.

As I mentioned, Oxford colleges provide tutoring for their students, and professors have small group sessions helping stu-

dents understand the material better. There are also *collections*, that are internal college exams that are not a part of an official departmental evaluation. I was marking home assignments for Shimon's tutees, and also was marking collections on AI and Machine Learning.

While marking was bringing some money, it was tough! First of all, a lot of questions were proofs, and you cannot simply say that that proof was wrong because it did not follow the model answers. There are multiple ways of proving stuff. Second, some people had horrible handwriting, it was extremely hard to follow the argument when you could not even parse the text. Some bloody Oxford geniuses even sent me photos of a whiteboard with only a part of a solution.

Sometimes it was funny, but generally it was hell, and took too much of my time³. I remember ordering a Papa John's pizza to Thom's building at 3 in the morning to help me get through the night of marking. I was going back to Castle Mill dorm around 6 am when most of the people were going to work, and it felt awful.

'Felt like shit again' was a common diary entry back then. Luckily, I early realised that marking took too much of my time, and never marked anything after my first year apart from one RL tutorial session I had later in my third year.

* * *

Everything changed when she appeared on my horizon. By her I mean the 'Relational Inductive Biases', another life-

³I probably took it much more seriously than I should have.

I'm super
miserable
and not sure
if the
decision to
go for a PhD
was a good
decision.

trajectory-changing paper. This was the first time I understood what Graph Neural Networks were, and why they can be useful. I read the GCN paper before and did not really get it⁴. The ‘inductive biases’ paper was so visual and clear, I had goosebumps when I was reading it on a train to London. It was amazing!

I know, some people grumble that this paper did not introduce anything new, but I disagree. Its novelty not in the new model or any groundbreaking result, but in the formalism it provided for us to have a mental model of any message passing graph neural network we could possibly think of. It gave me a tool helping me understand all the other papers in the field.

You do not really learn something until you implement it. And I decided to implement GraphNets myself. Back then, the original implementation was in tensorflow, and I decided to give it a go in Pytorch. Pagan (pgn) was born⁵. This was one of the most exciting times I spent in the lab during my first year. I remember coming there really early while the lab was empty, and working for an hour or so before the classes started. My original implementation did not have batching, and it was so slow, it was impossible to use, but I was learning.

Batching graphs seemed so elegant: you assume everything is a single megagraph where single graph components are not connected to each other, and, as a result, the messages do not pass between their nodes, and they are fully independent. I spent many hours⁶ profiling the code and trying to understand

It turned out, there is much more work as I expected (surprise!).

All the suffering seems justified now =)

⁴Sorry, Thomas.

⁵<https://github.com/yobibyte/pgn>

⁶I was not that productive, yes.

why my experiments were so slow. Pytorch-scatter looked like a gift from the gods.

It was not
because I
was stupid.
The topic
was rather
hard.

I also have a funny story regarding this paper, I broke Google Scholar with my paper notes. If you go to the Google Scholar page of this paper and click on ‘all versions’⁷, it will list my paper note as one of the versions of this paper. It looks like if you have a pdf online with the title of the paper, it gets parsed as another paper version, and you can do a lot of cool stuff hijacking other people’s papers. For instance, you can debunk the paper and have it linked on the original paper’s page on Google Scholar.

* * *

Looking at people around, I got this dangerous fixation, that I needed to publish a paper after the first year of my DPhil. Partially, this was also due to my false impression that I knew what I wanted to be doing which turned out to be pure delusion. Anyways, I was trying to do some research on the side while going through courses at the CDT.

I really believe that pressure to publish is one of the reasons we have so many papers that barely work coming from popular labs. If you are a fresh PhD student, you come and see that people around publish ten papers a year. There are two directions you might take from there: you can cherry-pick, oversell, not tune your baselines and do a lot of shady stuff, or you can be a bit more honest and silently suffer when nothing works. I decided to take the latter path.

⁷<https://scholar.google.com/scholar?cluster=17278816121299075983>

I ended up doing collaborating with other Shimon's students, working a bit on meta-learning with Kyriacos and Luisa. Not sure how helpful I was research-wise, but I was having great time⁸. Thinking about this now, for me this is peak DPhil and research experience. We were getting together at Kiko's place and were brainstorming, coding together, figuring out where the whole thing was going. Part of the great atmosphere for me was that this was not my project, and I was only helping. I had zero pressure to make this work as soon as possible, and could take time to go on a tangent or satisfy my curiosity.

Worked till 3 am.

In general, the best thing about Shimon's lab was that students were collaborating a lot, and usually one worked on their own project using other students' help, and they were expected to help someone else on their project.

* * *

One more project I worked on during my first year was the one that turned out to be the HOOF paper⁹. Supratik has this great idea of tuning policy gradient parameters on the fly, and I was running some experiments there. The most memorable moment of that was when I was doing gradient update into an opposite direction without realising that. Luckily, Supratik quickly noticed that and got it fixed.

In the evening I remembered that Supratik also got shitty results and I suspect the problem is in the shitty weighted importance sampling comparison.

I liked working with Supratik. He was a rare example of a DPhil student who was very chill, and submitted his papers

⁸[link](#)

⁹<https://arxiv.org/abs/1902.06583>

half a day before the deadline and went home while everyone was frantically refreshing the submit page panicking about sending a wrong version. Everyone was doing the last checks often after the submission deadline until the system still allowed that.

He also preferred to do a lot of thinking before actually coding stuff, an incredibly smart thing a lot of the people, including myself, ignore. In retrospect, I think I could have learnt more from him, and if I did, my life for the next couple of years would have been much simpler.

* * *

Year one was mostly a year of happiness of my DPhil. Why is it so? Partly, it was less lonely as we hanged around more with Panos and Alessandro, and had common homework to do and common space to stay at. However, there was something else, I allowed myself go on a tangent without any guilt. I could read something, and then fuck around for a week without expecting anything out of it. I was satisfying my curiosity, and it felt great. Unfortunately, I did not take it away as important lesson of the first year, but if I did, my DPhil would have taken a different trajectory.

I read a lot, often too much, my Mendeley inbox was growing exponentially. I tried to keep up with the Arxiv firehose, was going over textbooks found in the college library, and also read old ML/RL papers trying to discover the lost art ready to be resurrected by adding neural nets on top. I was also read way beyond my zone of comfort to get a broader view of the field.

Worked till 4
am in the
morning.

* * *

Our lab's reading group was another amazing experience of my first DPhil year. We meet in Robert Hooke building, and, usually, one person presented a paper going section by section, and we were all trying to make sense out of it together. There was always a plate of fruit and a cake, and discussions were incredibly interesting and stimulating. My paper notes¹⁰ idea was born there.

The atmosphere was usually quite hostile to the paper, this was a room of reviewers#2 dissing a paper. Some people found this was too much, but often criticisms were justified, we were dissing papers not just for fun. Sometimes, people got inspired to run some experiments, and projects were born after discussions at the reading group. Presenting papers was also great learning experience and good preparation for conference reviewing.

This was peak times of Shimon's research group, and partly I chose the lab based on my reading group experience and talking to students there. I heard that people were jealous of pre-COVID Shimon's lab as students there collaborated a lot, there was always something going on and people hanged out together all the time. I know in some of the labs it was totally different, where people did not speak to each other for the whole day and came to the lab only to connect their laptops to external displays and type. I could not imagine myself working in such a lab, but I got an idea how it felt when COVID hit.

I'm back again to the state when you have no idea what's going on All the previous times it did not end well for me. I think, this is a test for my persistence now. Good luck for me.

¹⁰[link to Notion](#)

* * *

One benefit of a popular University city is that there is always someone interesting who gives a talk and is around to have a coffee with. Only during first year, I met with Michael Bronstein, Peter Battaglia, Kyunghyun Cho, Xiaowen Dong and many other professors from Oxford. I also randomly stumbled upon Richard Dawkins on my way to the lab a couple of times, unfortunately I did not have a coffee with him.

Obviously, there are some people who are too busy or too arrogant to have a chat with a DPhil student, but most of them are extremely open and happy to discuss ideas, give literature pointers or just have a joke or two. You should use this for your advantage: not to increase amount of friends on Facebook, but just get a better feeling of what is going on in the community, what problems people care about, and what they think is coming next.

Speaking to other DPhil students, especially outside of your area, might also be useful and stimulating. Some problems are general across the communities, and often, you might find an interesting problem to work on with someone who has a ton of useful domain knowledge.

* * *

Every AIMS student got equipment budget, and a part of this budget was spent on shiny Macbooks for us to work on. I decided to give it a shot, but pretty quickly I got fed up with all the animations and interface sluggishness that I started

looking back at Arch¹¹.

Another guy in my cohort installed Arch on his Macbook, but I was not that adventurous. Luckily, one of the AIMS students got his laptop broken, and Wendy gave him my laptop in exchange for some part of his equipment budget. I had enough budget to buy a Dell XPS13, and set up Arch + i3 there, and could not be happier.

I also brought my desktop I had since my Masters, the desktop had a GTX1070 and several terrabytes of HDD space¹². I found it extremely helpful to have a GPU that nobody can hog, and which is easy to debug locally, before you start running experiments on the servers. Now I am probably more used to just doing everything via ssh, tmux, and rsync/sshfs, but back then I loved having things local.

* * *

AIMS CDT involves doing two mini-projects during your first year. Usually, this means an opportunity to ‘intern’ in a Computer Science, Engineering Science or a Stats lab looking for your future DPhil supervisor and getting to know their students better before you join. It is like a trial period for both, your supervisor, and yourself, which is really nice.

In practice, half of my cohort already knew who they want to work with, and mini-projects mostly gave students head start for their research, some additional time in a very short UK

I can be pretty well organised, but as soon as I have some deadline and I am under stress, I do only the stuff related to the deadline and a lot of stuff piles up.

¹¹Have I told you? I use Arch, btw.

¹²I am still using this machine as my home server, and run llama.cpp on it!

DPhil project. It was like that for me as well, I went to do my first mini-project with Shimon. I was all over the place trying to find applications of Graph Nets in RL, and multi-agent RL seemed like an obvious use-case.

I got quite excited first, and I liked working with Wendelin Boehmer, Shimon's post doc, who was really open discussing any ideas in front of a whiteboard and watching me pretending to be a centipede thinking about its gaits. Shimon got a great idea of bringing together the brave old and brave new world of coordination graphs, and graph nets. I got extremely excited, as I like connections like this, but the project was going quite slow, and we did not get anywhere within the first couple of months, with me trying to speed up my GraphNets implementation.

My impostor
syndrome
has started
to reappear.

Eventually, I ran out of time before my second mini-project, and Wendelin took over and eventually managed to bring this project to a publishable result, which was pretty cool. I, personally, became less enthusiastic about multi-agent RL after this project, and never touched it again.

Luckily for me, even before I started my DPhil, I got an internship offer from NVIDIA for the summer of 2019. Thanks to Wendy, I managed to arrange it as my second mini-project, as AIMS allowed working in an R&D department of partner companies. I packed a suitcase and boarded the flight to California.

* * *

The weirdest thing that happened to me when I arrived

to California for the first time is a huge deja vu feeling. I had been to that place as a child watching Hollywood movies, and it freaked me out. It was a love at first sight. My trip started on a major chord: the weather was nice, people were relaxed, and the coffee was good. I interned at the Applied Deep Learning Research team, and this was a life-changing experience.

NVIDIA was full of life-trajectory changing people, I will write about them here. The first one was Bryan Catanzaro, who was leading the ADLR. I had full freedom to pursue my interests, but it was not the freedom coming out of neglect and lack of planning. I had a choice to start a project Bryan suggested, join any of the existing ones, or start any other. I decided to take on the Boolean SAT solving that ended up being the Graph-Q-SAT paper. Bryan is extremely smart, but is also very kind and caring. Our conversations were insightful, but there was also a human connection part in them.

The second trajectory-changing person was Saad Godil, my direct manager. Saad taught me to be more pragmatic. NVIDIA is a very pragmatic company, and I loved it a lot. Sharp focus, no need in reinventing the wheel and coming up with the ideas which are pompous, but will never work is something that made my experience truly unique. Also, Saad was very senior, but he was very hands on. We pair-programmed, analysed there results together, and he was running experiments on his own. He was not a free-rider on the project which deserves a lot of respect.

I was writing about my impostor syndrome experience at MSR and how stressed I was all the time. With NVIDIA, it

Using Windows is horrible for your mental health, and they want me to use it for development.

Did not even go for a run. Played Diablo III all night long. Was a bit depressed about state of the project.

was different. There were a lot of extremely intelligent people around, but I had more confidence in myself that time, and I quickly got a first version of Graph-Q-SAT implemented, and this was encouraging. It was stressful at times, especially closer to the end as I wanted to finish the full paper before my departure, and it was quite tight. Sometimes thing did not work, but that was a part of the experience and surprisingly to myself, I was able to come through it all right. I put a couple of all-nighters, but in general I did not work extremely crazy hours, running helped, and when I was feeling exhausted, I gave myself some rest. Mental-health wise it was good, I was very happy at NVIDIA.

Nothing works again, but I feel less like I care and try not to give a fuck.

Every time I compare salaries, I want to be as far from universities, as possible.

It was also great at the human level. I got close with Rafael, another researcher at my team who was a professional musician before he did PhD in computer science. We went surfing to Santa Cruz, we rented a car and went to Tahoe with his girlfriend, my family and Sungwon, another intern. I think this helped me a lot to get through the first year of my DPhil, and I do not think I ever got as close with people during my internships at other places later. However, probably, COVID is partly to blame.

September approached quickly. I submitted the Graph-Q-SAT paper to ICLR¹³, wrote a blog post¹⁴, packed my suitcase, and boarded a plane to Heathrow.

* * *

¹³<https://arxiv.org/abs/1909.11830>

¹⁴https://yobibyte.github.io/nvidia_postmortem.html

I want to finish this chapter with the paragraph that is most hard to write. I feel incredibly guilty for putting my family life on pause, and spending way less time with my wife and my son than I should have. Luckily, I decided that the weekend is always work-free, and this helped a bit. However, nothing justifies so many late hours and all-nighters, spending time at MCR instead of with family, and cranky mood because of stress and lack of sleep. This is probably the main thing I regret from these four years, and I am lucky enough to have an amazing wife who came through this with me and decided to stay on my side.

I taught my son how to swim! I feel like I'm a better father than a machine learner. I should work for a kindergarten, I believe.

Now when the narrative became more grim, we are ready to go to the Year Two chapter, welcome to the year of frustration.

Year Two: Frustration

TBD

Year Three: Misery

TBD

Year Four: Reassessment

TBD

Epilogue

TBD