Statement of Purpose (Comp Bio, biostats):

* First paragraph intro to why I’m interested in computational biology. Maybe start talking about finance internship and about how something was missing as a quant. Then talk about fascination with computational biology and the era of personalized medicine which I learned about from Hacking Darwin.
* Discuss my work with Professor Ma in research
* My primary areas of interest include modeling complex biological systems (maybe talk about computational perception) and statistical methodologies to identify genomic attributes
* I am interested in MSCB because I continue working with Professor Ma in research that I find fascinating while also learning. I know that I want to work in industry where you have the opportunity to make a more immediate impact on people and you get to see firsthand more of the people you can help

My interest in computational biology first began with “Hacking Darwin: Genetic Engineering and the Future of Humanity” by Jamie Metzl. I was fascinated by the author’s account of where we will be headed in the next hundred years during the era of personalized medicine. Prior to reading this book, my perception of biology had mostly been about memorizing different parts of the body and you only study it to become a doctor. I wasn’t aware how the merging of statistics, computer science, and biology could antique much of modern medicine. This book completely blew my mind, and I took it upon myself to learn more about biology and how my statistics and machine learning background could be applied to this field. I met with a professor from the Computational Biology department and asked about his research and how I could get involved. Over the summer I insistently annoyed my PhD student advisor, clamoring for her to send me more articles to read. I worked as a quantitative trading intern at a top high frequency trading firm, by day, and computational biology activist by night. I would get home from late at night from work, and eagerly open up my laptop to read about \_\_\_\_\_ for the next few hours before going to bed and restarting the cycle again. I thought that the work and algorithmic analysis I was doing at the trading firm was no doubt interesting, but I couldn’t stop thinking about computational biology. The implications of the work were just too cool.

Once my internship ended, I headed back to school to continue my work with Professor Ma in the Computational Biology Department. My role has been \_\_\_\_ and I am still learning a lot about \_\_\_\_\_. I hope to continue working on similar research in graduate school, where I can apply what I have learned and contribute with insightful findings in biology. My primary interests lie in the computational modeling of biological systems and statistical methodologies for genome examination. I think it is really fascinating how we can take the incredibly complex biological systems and succinctly express how they work with mathematical and statistical models, although often they rely on questionable assumptions.

I am interested in this program, because I would like to learn more about biology from a mathematical perspective. I have spent my undergraduate years building up a solid quantitative background in statistics and machine learning as well as a meticulous computational problem solving approach. I want to go to graduate school and apply my knowledge and skills to problems in biology, so that I will be well prepared to solve these kinds of important problems when I go into industry and people are depending on me.

After I complete this program, I see myself working at a biotech startup. My hope is to be working at the cutting edge of biotechnology, where I can see my models and analysis being used to help people.

Statement of Purpose (Machine Learning, statistics):

Machine Learning: your objective in pursuing a graduate degree in Machine Learning; your background in particularly relevant fields; any relevant academic or research experience; and any additional information you wish to supply to the Admissions Committee.

Statistical Practice: why you're interested in the MSP program, your qualifications, and your goals.

When I was first trying to teach myself about machine learning, there were an abundance of resources for me to explore and learn on my own. However, with recent research findings, there are no other sources to learn about the details of the research aside from the research paper itself. Reading these advanced research papers has helped me absorb information that can only be seen in one form.

When I first came to Carnegie Mellon, I knew next to nothing about machine learning. I had never really programmed before, I didn’t know what computer science was, and I did not enjoy my time in AP Statistics. But, I was fascinated by the idea of machines learning to adapt and learn by themselves, and I wanted to know how it could be done. I realized that to understand machine learning algorithms I needed to know how to program, so I signed up for 15-112 and started reading about neural networks. After quite a bit of reading and a lot of confusion, I started to understand neural networks and how to implement them, and I soon built a neural network to evaluate moves for a chess AI. I was inspired by my progress, and I became intrigued by the math and statistics underlying the machine learning algorithms. I was committed to learning more, so I switched my major to statistics and machine learning, and since then I’ve had unique growth opportunities from machine learning projects and interesting classes at CMU.

10-701 was a seminal class for the evolution of my machine learning skills, because it taught me how to be independent when solving complex problems. The class final project had the most significant impact on my development, because after two of my teammates dropped the class, it was left up to me and my one partner to complete the entire project. I was pushed to explore every aspect of the data analysis and modeling process myself, which made me comfortable with creating plans, putting them into action, and deriving insights given only very open ended questions. The minimal help and guidance on this project truly cultivated my problem solving abilities, which translated into my work as a quantitative trader as well as my research in computational biology.

My work as a quantitative trader this past summer was focused on predicting optimal order cancellation strategies for ETF orders sent into the market. My experience in 10-701 really helped me break down this problem and conceive of reasonable hypotheses for good order cancellations. I was able to discover useful indicators of certain price shifts and engineer a profitable model for order cancellations, which was validated on future data. I really enjoyed learning about machine learning applied to finance, and it was very enlightening to actually work on machine learning projects in a work environment where I had to meet deadlines, consistently report my findings, and provide detailed explanations for my methods. I learned to make my code concise, organized, and fast and to test my code as I write it, instead of after. I also learned how to articulate my work to a less technical audience, since I presented my findings to a varied audience of quantitative researchers, sales traders, and HR employees. I am fascinated by the applications of machine learning to various fields like finance, and I have been doing research to understand the applications of machine learning to biology.

When I started my research in computational biology in May, I had not taken a course in biology since high school. Initially, I struggled considerably to read research papers where I could barely understand the novel statistics and machine learning methods that were being developed no less the biology underlying these methods. However, this strenuous process of reading prior work to better understand my research and how to contribute has given me a much better understanding of biology, machine learning, and research as a whole. I feel much more comfortable exploring new areas, regardless of my lack of experience in that area. I often still struggle to read new research papers, but I now understand how to identify what I am confused about and what I can do to understand it. Most importantly, I have learned how to identify relevant prior work and adapt it to create new machine learning methods that are useful to my research inquiries.

These experiences have prepared me to successfully study a rigorous graduate machine learning curriculum and have also solidified my passion for machine learning. I have come quite a long way since I was working on my chess AI in 15-112. I can think of so many ways to improve it (like maybe having the next move follow a probability distribution instead of always making the same move for each board), and I’m sure that by this time next year I will have even better improvements in mind. I have found these past few years at CMU to be the most transformative of my life, and I want to keep learning at CMU which has an incredibly diverse faculty who are eager to support their students and their explorations of different fields. The courses that I am taking now like Text Analysis (36-468) and Computational Perception (15-387) are giving me exposure to how machine learning is uniquely applied in the fields of linguistics and neuroscience. I hope to continue my research in computational biology and also keep learning about different applications of machine learning from faculty all throughout CMU’s diverse departments. I plan to make the most of my graduate education just like I have done for my undergraduate education, and I’m excited for whatever lies ahead.

Thank you for your consideration,

Michael Kronovet

Two years ago, I joined Carnegie Mellon University as a business major. Looking back now, I’ve come a very long way since then. When I first entered CMU I didn’t really know what I wanted to do, but I was eager to learn, and I spent the first year mostly exploring my interests. My freshman fall semester I took my first computer science class, which exposed me to an entirely knew way of thinking. I learned so much from the class, and I went to every one of the optional lectures and talks about computer science and talked to TAs to learn more about other fields of computer science. Eventually, I heard a talk about machine learning, and so I started doing my own research into it, and I became enthralled in the field. I was so intrigued that we could use statistics and computer science to build models that essentially learned by themselves what to do so that machines could learn to understand problems that humans really couldn’t. This kickstarted my fascination with machine learning, and at the end of the course for my term project, I built my first neural network from scratch to make a chess AI. Since taking this class I have focused on developing my skills in applied statistics and machine learning, which I hope to explore more rigorously in graduate school.

I want to pursue this graduate degree so that I can have a more rigorous understanding of machine learning and get experience applying it to many more different fields so that I don’t blindly jump into a job after school. Since I am graduating a year early, I know that I still have a lot of exploring to do to see what machine learning applications interest me the most. I think that my base knowledge in statistics has grown considerably, but through my courses I have learned that I still have so much that I want to learn. The program gives courses with \_\_\_\_\_\_ and would allow me to continue doing research and applying machine learning methods to various fields. At the end of this program, my goal is to come out confident in the field I want to go into and well prepared to succeed in that field. I will take it upon myself in this program to rigorously explore various machine learning fields and applications by research projects with faculty, relevant internship/industry experience, and interesting coursework which I will engineer to push myself to get the most out of this program.

Thus far I have experience applying machine learning to biology and finance. I have been exposed to how incredible machine learning is and how to apply it to complex problems in different fields. I am well versed in machine learning and statistics from my coursework in classes like 10-701 Intro to Machine Learning for PhDs, 36-402 Advanced Data Analysis, 36-462 Data Mining, as well as many other relevant courses. I recently finished an internship as a quantitative trader in finance and it taught me a lot about data science and applying machine learning. I am very eager to explore other fields as well and I have joined professor Ma’s research group to apply my machine learning skills to problems in computational biology. I am eager to learn more and I hope to get more rigorous and varied experience in machine learning through the masters program.

These past 2 years at CMU have been incredible. I’ve learned so much and met so many smart and kind people. I hope to continue my education here and keep growing. I just found the field that I love, and I want the academic rigor that only graduate work at CMU can provide. I plan to use the skills I learn to their fullest potential and continue learning especially after I graduate.

ANSWERS TO RANDOM STUFF

One project that highlights helped me develop some very important skills would definitely be the final project for my PhD Intro to Machine Learning course last semester. The final project typically consisted of four PhD students working together to build and implement a machine learning algorithm to solve a problem of their choice. However, after two of my teammates dropped the class, it was left up to me and my one partner to complete the entire project. I was pushed to explore every aspect of the data analysis and modeling process myself, which made me comfortable with creating plans, putting them into action, and deriving insights given only very open ended questions. The minimal help and guidance on this project truly cultivated my problem solving abilities and machine learning skills, which translated into my work as a quantitative trader as well as my research in computational biology. The end result of this project was that my partner and I built a machine learning model to output the year a song was released given its lyrics and various musical qualities of the song. It was a really fun project, and I'm glad we stuck with our initial idea despite us having to take on more work. You can read more about it on my website, https://michaelkronovet.com, as well as some of my other projects if you are interested.

A few years ago, I realized that I wanted to pursue a career in machine learning and data science, but I was unsure of what field I wanted to apply these skills to. I initially thought that finance would be interesting as well as lucrative, but when I was an intern at a quantitative trading firm last summer, I couldn't see myself working in that field. Instead, I found myself really intrigued by the computational biology research that I had started working on. I find problems in biology to be fascinating, and I think that it is a great way to do meaningful work that helps people. So, I decided to pursue a career in bioinformatics research, where I am able to leverage machine learning to provide insights into problems in biology. I plan to either go to graduate school and stay in academia for research or work at an institute for research such as the ISB.

I think that each of the areas of biology mentioned above are really cool, and I would be interested in learning and working in each of them. Computational biology is what interests me the most, because I want to look at problems in biology from a mathematical perspective. Each of these fields has a lot of interesting computational biology work underpinning them, so I would be excited working in any of these. I am eager to get involved wherever I could help the most.

During my senior year of high school, I was interested in building a muon tomography device with a few friends. We read a couple papers about muon tomography so we could understand how the devices worked, and then we spoke to a professor in optics to ask him what he thought the feasibility was for us to build out own device. He told us that we had no chance because the current methods costed millions of dollars. Undeterred, my friends and I invented a new way to measure the trajectory of muon particles to use for muon tomography, and we built a prototype. We presented our method and prototype at the Intel International Science and Engineering Fair and won third in Physics and Astronomy.