**What is a Machine Learning Engineer?**

**Attempting to understand an ambiguously defined role in the AI/ML industry**



Title card created by the author

I am a principal machine learning (ML) engineer at a Fortune 50 company, and one of the questions that I am asked most often is the same one posed in the title of this post: “What is an ML engineer?” The truth is that there doesn’t seem to be a one-size-fits-all answer. While I am definitely not actively looking for a new role, I actually enjoy looking at job postings from other companies just to get a feel of what other companies are looking for in terms of skillsets for ML engineers. The reality is that when it comes to roles like data scientists, ML engineers, and even some kinds of software engineers, there is a lot of overlap in terms of what is expected of skillsets. Company A might define the role of an ML engineer the exact same way that Company B defines a data scientist role, with each of these roles performing the exact same activities despite the differences in title. These definitions really do range quite a bit!

That said, I’m not going to try to nail down a very precise definition of an ML engineer. (Because I’m sure I’d make somebody mad if I tried to do that!) Instead, I think a more useful examination would be an understanding of the **skillsets** generally associated to ML engineers. After analyzing those skillsets, we’ll specifically juxtapose the skillsets of a general ML engineer with a general data scientist, specifically since one of the questions I hear most often is, “What is the difference between a data scientist and an ML engineer?” Finally, we’ll wrap things up with an analysis on the direction I expect the industry head so that you can best prepare yourself for the future.

**Primary Skillsets of an ML Engineer**

Though it is difficult to nail down a precise definition of an ML engineer, we do at least see enough commonality in skillsets that we can broadly group them into three collective categories: **machine learning / deep learning**, **software engineering**, and **technical architecture**. Below we’ll analyze more closely what each of these three categories entail. Before moving forward, I do want to address one skillset you might notice curiously missing from the list: data engineering. I intentionally omitted data engineering from this list because I actually find more often than not that this skillset often requires its own role, so while it’s definitely not impossible for an ML engineer to perform data engineering in their role, it’s more often relegated to a role like a data analyst or data engineer.

**Machine Learning / Deep Learning**

This one is the no brainer; it’s right in the title! This involves an individual building a predictive model to solve some sort of business problem using machine learning and deep learning algorithms. We’ll get into this a bit more in the next section, but it actually seems that ML engineers more so focus on more computationally complex problems that end up getting integrated into real-time systems. In other words, I hear a lot more ML engineers focusing on more deep learning problems like computer vision or natural language processing (NLP) than I hear them solving problems that involve structured, tabular data. Again, this isn’t to say that an ML engineer never builds predictive models for tabular data. Part of the reason that I believe that an ML engineer often spends more time focusing on building more computationally complex models is because it requires our next skillset…

**Software Engineering**

When it comes to deep learning in particular, it is an absolute “must” for an ML engineer to have a software engineering skillset. Regardless of if you choose to work with TensorFlow, PyTorch, or even other less computationally complex algorithmic libraries, pretty much all machine learning manifests itself in the form of software-engineered code. Most ML engineers are required to understand the Python coding language specifically, but it’s not uncommon to request an ML engineer to understand a secondary language like Swift if building iOS applications or Java if building Android applications. Additionally, because applied machine learning manifests itself as a software product, ML engineers are often required to understand the basic things that go along with any other general software engineer role: unit testing, security scanning, CI/CD pipelining, and more.

**Technical Architecture**

Because applied machine learning / deep learning manifests as a software product, it is very common for an ML engineer to have a technical architecture skillset. This is the whole idea of building a “blueprint” that demonstrates how a whole system works together and functions appropriately. This sort of work is often not completed in a vacuum. In my own role as an ML engineer, I partner alongside other more general technology / software engineers to understand how my machine learning APIs and batch inference solutions play a role in the whole, overarching system. Because many companies are moving to the cloud, it is common for a company to request that an ML engineer understand cloud services like Amazon Web Services (AWS), Google Cloud Platform (GCP), or Microsoft Azure on a pretty intricate level. It’s often required that an ML engineer knows how multiple services within one of these cloud platforms play together in order to appropriately deploy a machine learning solution.

**Juxtaposing the Data Scientist Role with the ML Engineer**

Before jumping into this next section, allow me to reiterate once again that companies define these roles quite ambiguously, so don’t be surprised if these definitions do not match your own experience. A question I hear frequently is “What is the difference between a data scientist and an ML engineer?” Or even more succinctly, “Is there a difference between a data scientist and an ML engineer?” I think the answer to the latter question is yes, but “drawing that line in the sand” is a difficult task.

Let’s take a step back to understand what data science is in general. Data science is referred to as such because it mirrors the **scientific method**. Yes, this is the same scientific method that you probably learned in your high school biology class. **Essentially, data science looks for patterns amongst data by setting an experimental group and a control group and analyzing the probabalistic difference (p-value) between them to understand if there is any statistical significance.** If we can find a statistical significance, then we can build predictive models that can draw inferences on future data.

In this form, **data science does not have a direct, 1-to-1 correlation to machine learning**. In other words, we don’t always have to use machine learning to build predictive models. The insurance industry in particular has used mathematical algorithms like generalized linear models (GLMs) for well over a century to great effect without the need for machine learning. In fact, many actuarial analysts and statisticians have actually been recently re-titled to the role “data scientist” for this reason, and I would agree this is a very fair action. (Fair, but it feels to me more like a marketing / recruitment tool more than anything. 😂)

With this understanding of data science, you can start to see a dichotomy between the skillsets of a data scientist and an ML engineer. A data scientist is often required to have a stronger mathematical background but less of a software engineering background since they can rely on “low code” tools like the industry favorite SAS tool to complete their work. I have the pleasure of mentoring many undergraduate and graduate students at many of the top-name universities majoring in data science, and they will tell you this is definitely the focus. What is curiously NOT the focus with any of the students I’ve talked with is any emphasis on software engineering nor technical architecture. When it comes to machine learning, students often spend the bulk of their time coding a machine learning algorithm (e.g. support vector machine, naive bayes, gradient boosted trees) from scratch in the C++ programming language.

**The Future of the ML Engineer Role**

I want to be very careful so that it didn’t sound like I was downplaying the value of a traditional data scientist role. Data scientists are still extremely valuable, as they have proven their worth time and time again by building these great predictive models that provide a lot of value to a company. **At the end of the day, it doesn’t matter if it’s machine learning or not: business value is business value**. (And to be clear, a lot of data scientists do use machine learning to derive that business value.)

That said, we are already seeing the emergence of new technologies that are going to require the additional skillsets of software engineering and technical architecture not traditionally found in the data scientist role. In my analysis of job postings across every major company, I see more of an emphasis placed on these additional engineering skillsets and thus more of a growing need for ML engineers in general. Sure, they might not necessarily go by the title “ML engineer”, but you can absolutely expect to see a continued interest in individuals with a combination of the three skillsets mentioned above.

The good news is that if you’re a data scientist today with a strong mathematical background, I personally think that is the hardest skillset to acquire. Yes, it is not easy to pivot into a new skillset, but I would imagine it’s easier for somebody with a strong data science background to obtain a software engineering skillset than vice versa.

Hope you enjoyed this post! Reiterating for the final time: your experience with how the ML engineer role is defined will vary. I personally have very much enjoyed my time in this role! It provides this great middle ground of right brained creativity when building models that solve really interesting problems with left brained engineering to implement those models. I’m very excited to see where the future of our industry goes! 😃