

## Why Your Algorithm Will Fail

### Reason 2: Overfitting

Have you ever heard the phrase “fit like a glove”?

Great.

Now imagine trying to put on a glove made for this guy:



Impossible, right? It would barely fit, if at all. Here's where our problem starts to emerge. There's a problem called **overfitting**, and it occurs when a model is so tuned to one data set, that when you introduce another data set to that model, it adjusts very poorly - like a glove made for Hanson from Scary Movie 2. An overfit model is **specific**, **random** and **unable to generalize**. Here's another comparison to explain **overfitting**:

Imagine you're a plumber instead of a trader. You live in a small, familiar town. Your trading strategies are now represented by a set of shiny wrenches. They are all individually sized, but quite cumbersome, so you only have room for **one** per job. You've had 3,000 jobs over the last 3 years of your plumbing career, and most of them only required a 10 mm wrench. Whenever you needed a different wrench, you went home and got it.



## Trading strategies

Now, I know what you're thinking - "But I have *many* trading strategies. What do you mean I can only use *one*?"

Think about it. Although you can have many trading strategies, you can only open a trade according to one strategy at any given time -

So you can only bring one wrench to any plumbing job.

Now, imagine you move to a new city for a job with a new company. Which wrench do you bring to your first job with this new company?

How about the 10 mm?

Probably not the best choice. You see, although the 10 mm wrench was a perfect fit for most of your previous jobs, you need a more **general** tool to operate confidently in your new work environment - without being worried that it's **overfit** to your old work environment.

With this in mind, I'm going to say this twice for emphasis: Overfitting is when a system fails to generalize. **Overfitting is when a system fails to generalize.**

If you've only got room for one trading strategy - I mean, wrench - then you've got to pick the one that can do it all. Right?

Right.

Let's talk about the wrenches (trading strategies) in your toolkit. Each wrench has a **specific function**, and a corresponding **name**. This, actually, is the exact definition of a **polynomial**, which is just a fancy Greek word for "many names." Polynomials are important concepts in math, but for now, you just need to know what they do. Polynomials **bend** lines, similar to how wrenches **turn** bolts. That's it? Yup. Easy enough!

Polynomials are **specific**. The more **specific** a polynomial is, the more **specific** it can be when fitting to points in a dataset. In our case - price, which is also just a big, bendy line. This is great, right?

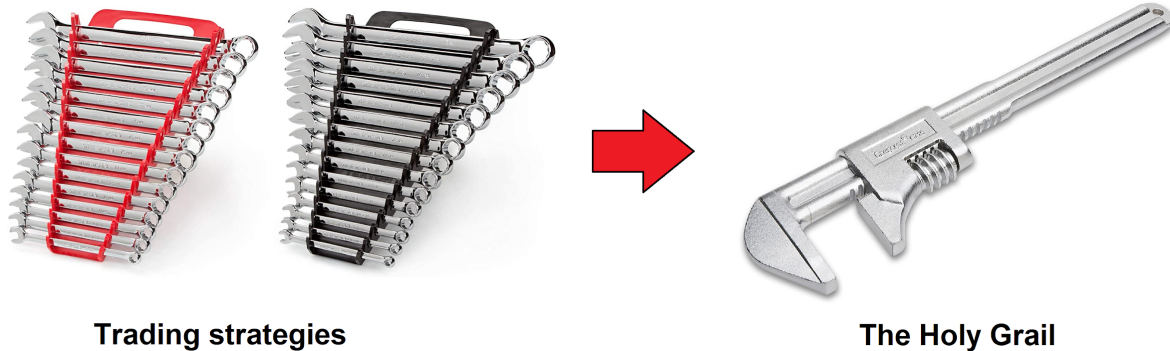
### **Wrong.**

Being **specific** works until you move to a new city, with a new job and new clientele - or in a trader's case, a live trading environment. Although your assortment of wrenches provide a great deal of flexibility in theory, in reality, none of them **generalize**. They are **specific**.

And what do we mean by **specific**? Simply put, **specific** means **not something else**. You need to understand that your wrench (trading strategy) is a polynomial. **Polynomials become more specific as more input variables are added to them**. If you're optimizing 4, 5, 6, or more inputs at a time, you will make your strategy increasingly **specific**, and **unable to generalize**. Why is this problematic?

Well, market movements closely resemble a **random** walk. In statistics, **random** means **non-deterministic**. Because market history is basically **random** but **specific** data, choosing a wrench based on how well it **fits** that data is a bad idea. When you do this, you are just choosing a **random** wrench that can't adapt to new data. In other words, you need a wrench that can **generalize**.

Introducing - the **adjustable monkey wrench**:



Obviously, the monkey wrench **generalizes** better than any of the wrenches in our toolkit. It has more **predictive power**. We know it's the better option. But **how do we actually choose it?** Keep this question in mind as you continue.

Now, let's say you are building a trading system from scratch. During the optimization period, your system looks fantastic. Of course it does. You forced it to. It's **specific**. But when you extract parameters from this optimization and choose the "best" ones to forward test or trade with, you are essentially moving to a new company with nothing but that **specific** 10 mm wrench -

By now, we know that this is a big mistake. But let's say you do it anyway -

You show up to your first job with your trusty 10mm wrench, and it works perfectly.

Then you do it again. And again. You feel a sharp **rise** in confidence (remember Dunning-Kruger?)...

At your next job, you find that you are totally unprepared. Everything goes wrong. Your wrench can't adjust to the job, and you waste hours going back and forth from home to get the wrenches you need.

No big deal, right? Then it happens again. And again. This time, the customer complains, and your boss - Mr. Margin - finds out. He **calls** you into his office, **pissed**:

"You show up to work with a **random** wrench, waste my time, your time and our customer's time?! - **YOU'RE FIRED!**"

You know the drill -

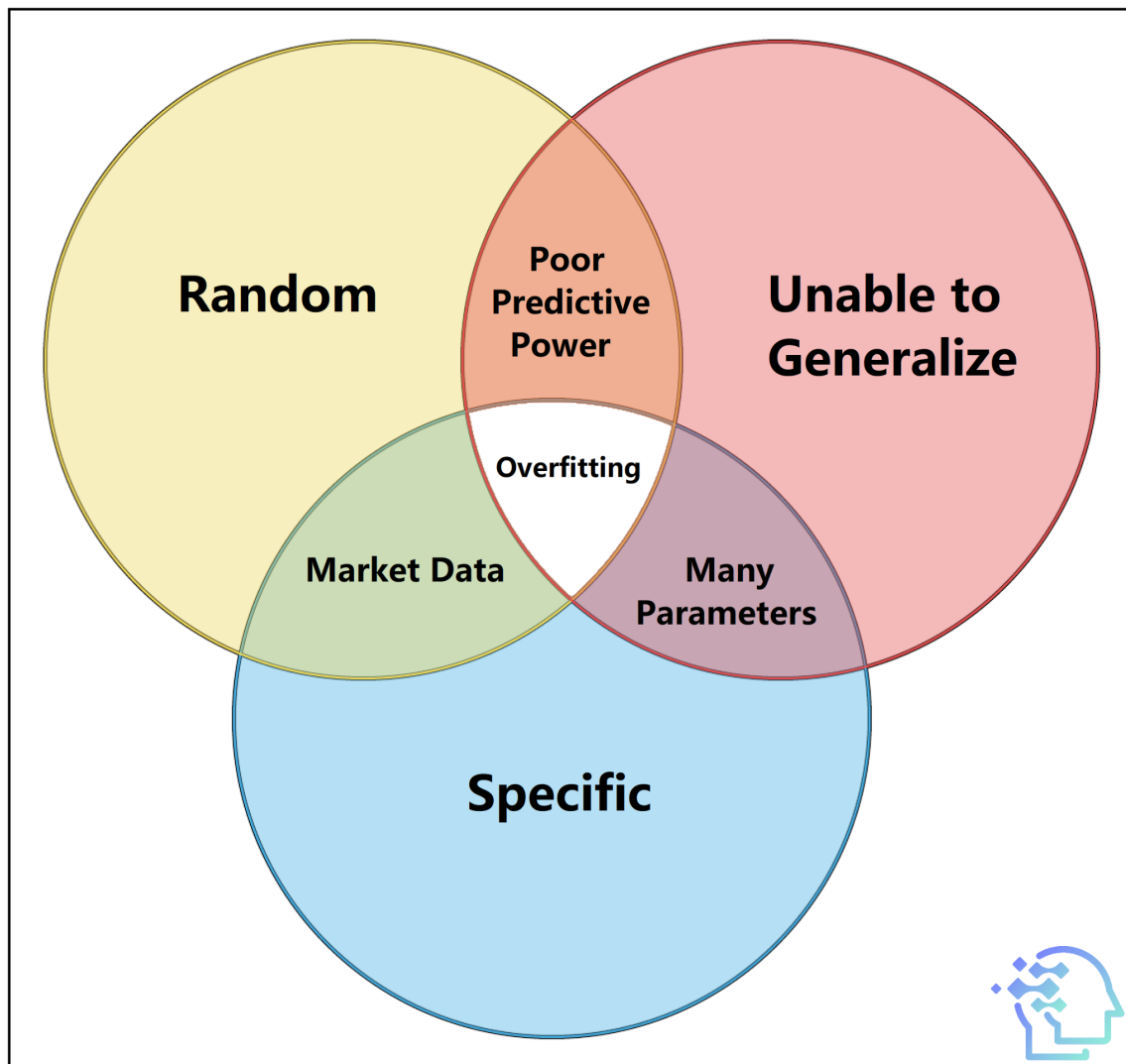
You tear your hair out, punch a hole in the wall, and your wife leaves you for some guy with a monkey wrench -

Another **severe** Dunning-Kruger episode.

What gives? Most of your 3,000 jobs over the last 3 years only needed that 10 mm wrench - and your boss calls it **random**? Doesn't he know about your wrench's impeccable performance history? It really worked! -

Right?

Maybe not. With all your new spare time, you think about why your strategy was unsuccessful. In a stroke of genius, you weave all the concepts we've discussed together into a comprehensive Venn diagram, like the great visual learner you are:



So, you're still an unemployed plumber (or a pissed-off trader in drawdown), but at least you know why. You crashed and burned because you overfit your strategy. But what can you do about it - **go back in time?** Maybe. If you use 10,000 jobs of history in your optimization instead of 3, you might be able to avoid choosing the 10 mm wrench at your new job. **But will you decide to use the monkey wrench, instead of another overfit option?**

Keep this question in mind as you read the next article in this series. It's a concept most of us take for granted, but one that ultimately determines the success or failure of any trading system: the **optimization process**.