RESEARCH

Create today.
Predict tomorrow.

Introduction to careers in Quantitative Finance

Dr Charles Martinez

charles.martinez@gresearch.com

gresearch.com

Agenda

Introducing G-Research

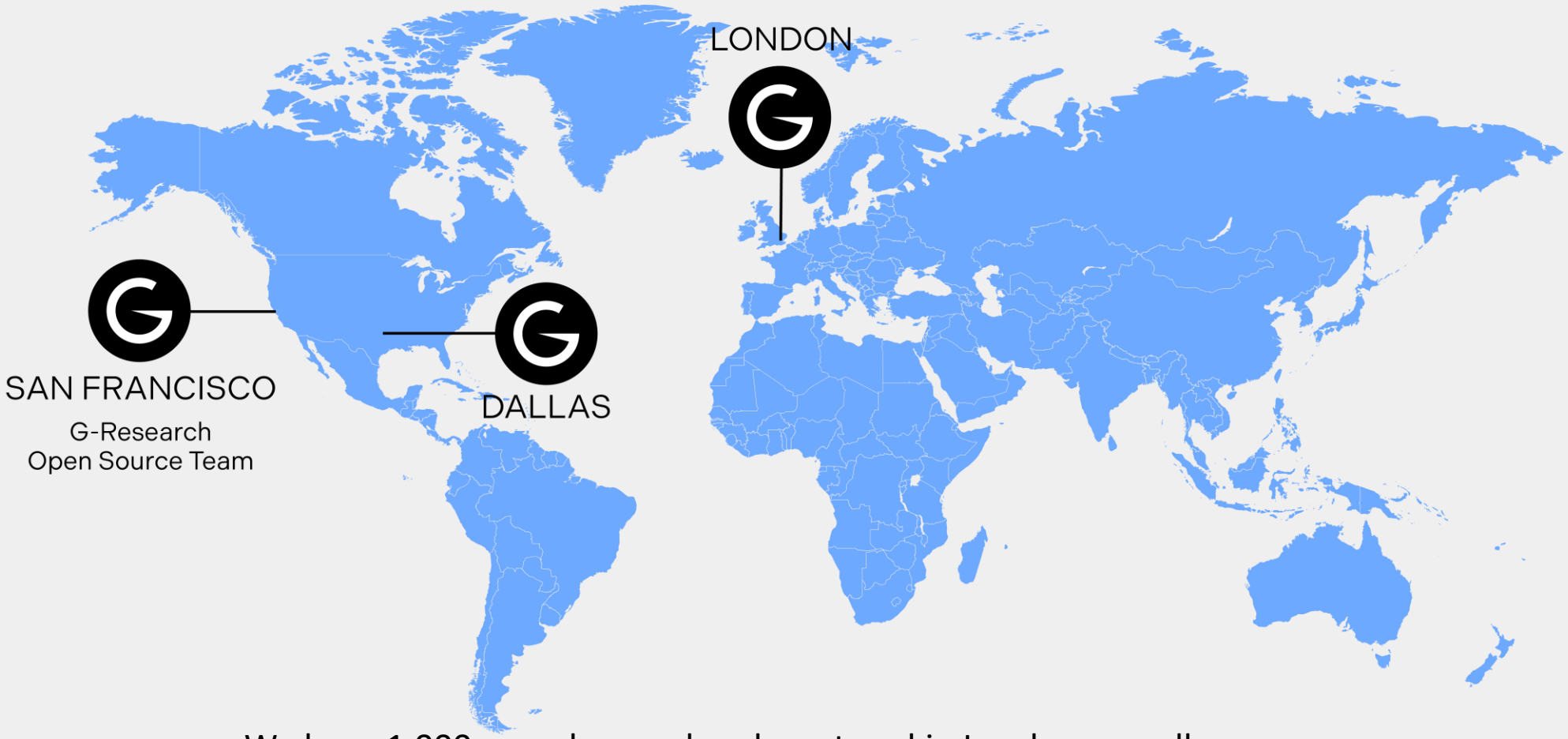
What does a Quant look like?

Our recruitment processes and schemes

Introducing G-Research

- G-Research is a quantitative research firm
- We develop fully automated algorithmic trading strategies for global electronic markets
- Our main focus is global equities but we also work in FX
- Our group trades in over 40 markets globally, 24 hours/day, 6 days/week

Global presence



We have 1,000+ employees: headquartered in London as well as an engineering hub in Dallas.

What is Quantitative Finance?

Lets say a company grew in profits. Quantitative finance provides you the tools to understand what made it grow, why it grew, if the growth was reliable, and what could have caused the growth to stop.

G-Research focuses on equities, an equity is the amount of money that would be returned to shareholders if all of a company's assets were liquidated.

Our activities are conducted in stock markets, which are venues in which shares are bought and sold.

What is Quantitative Finance?

A “feature” or “predictor” is any kind of basic independent variable that we think has some predictive value.

A trading signal is what you get when you take one or more predictors, and feed it to a mathematical model to create a trading decision. You can also “stack” multiple of these models, i.e. feed multiple models into another model that aggregates them into a trading decision.

A trading rule is a hardcoded trading decision. For example, “if there is only 1 donut left at £1, then buy the donut; if the price of the donut goes up to £2, sell the donut”.

A strategy puts together a bunch of trading decisions, by some combination of trading rules and mappings of signals to trading decisions.

A strategy that is only based on trading rules is a rule-based strategy.

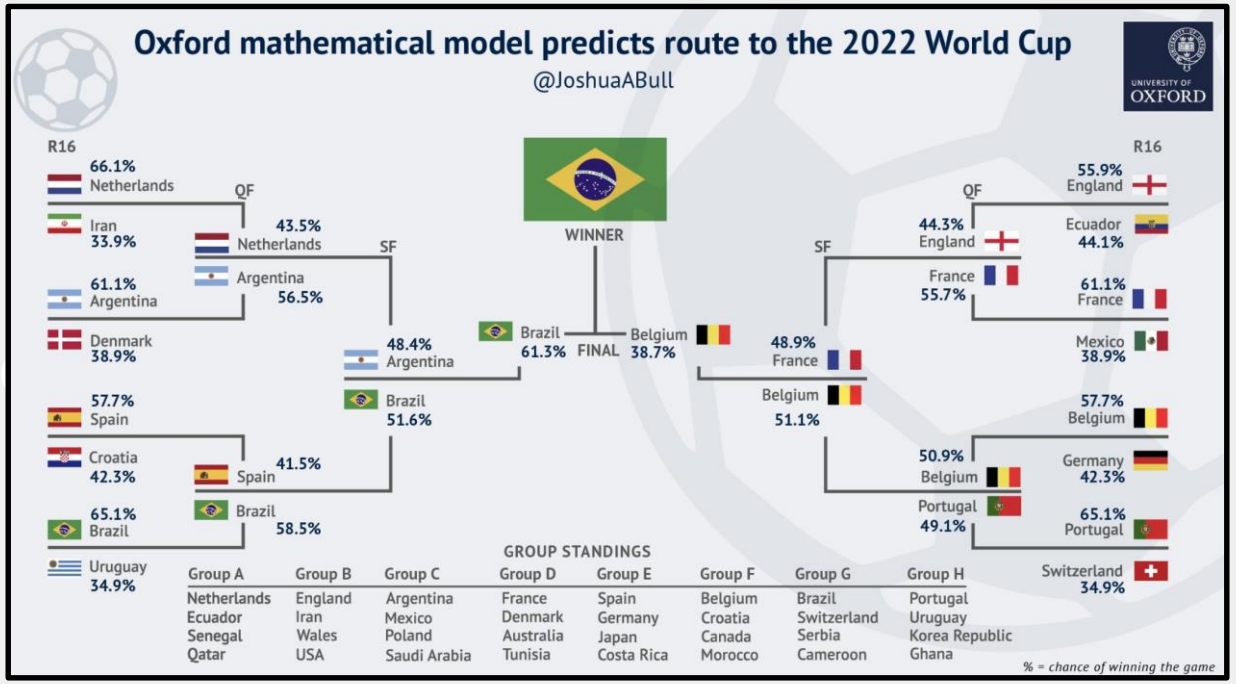
A strategy that is based on signals or models is called a model-based strategy.

The Strategy

A strategy can be as simple as placing a bet on who will win the World cup.

Data that would inform the strategy could include?

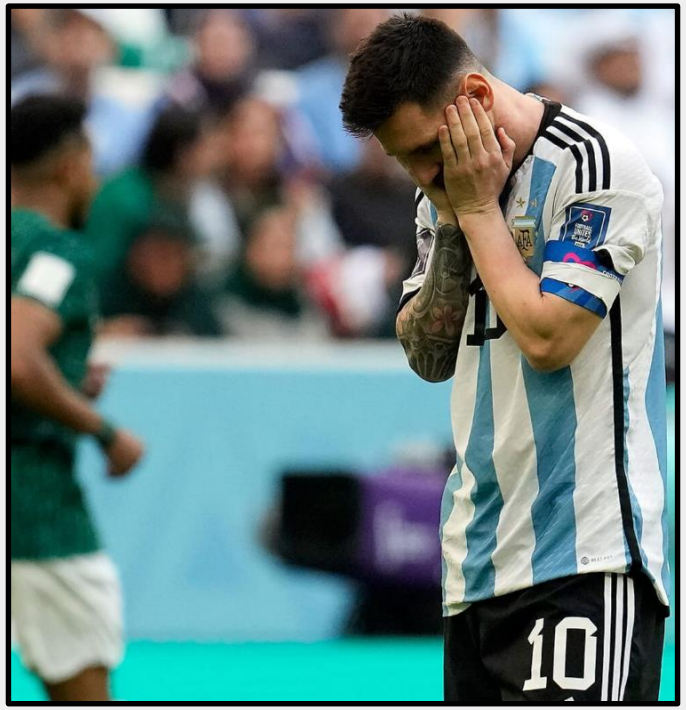
From these trends and observations you can estimate the strategy's degree of success



Risks

However nothing is ever plain sailing, the unexpected can happen.

What could happen to derail our strategy?



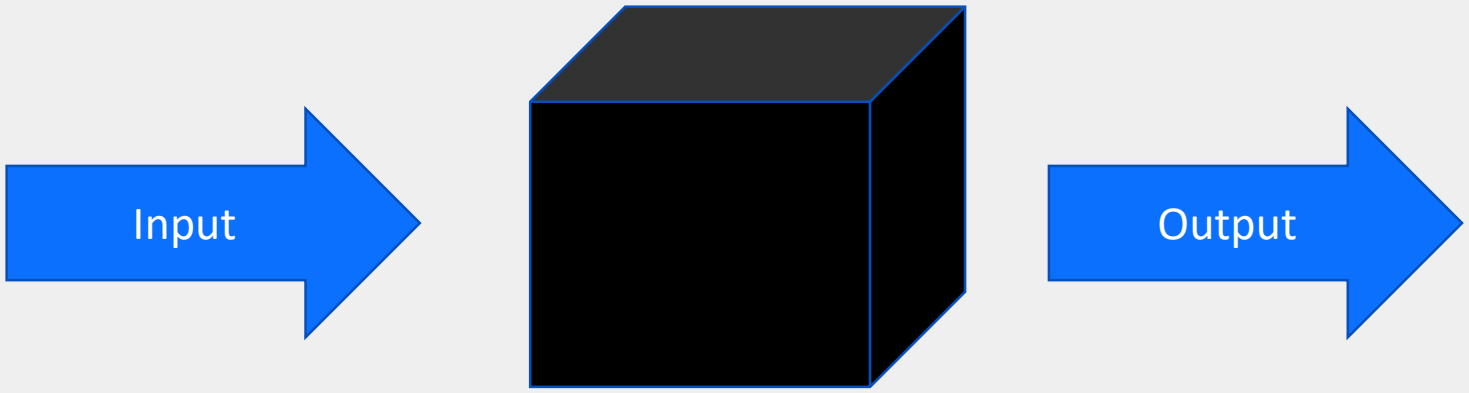
Transaction costs

Quants need to be able to effectively model the impact of costs on their portfolios and trades. In doing so, they seek to minimize the total transaction costs. There are several approaches for the modelling of transaction costs in portfolio optimization models and optimal execution applications.

The Black Box

- A black box is a device, system, or object which produces useful information without revealing any information about its internal workings.
- Financial analysts, hedge fund managers, and investors may use software that is based on a black box model in order to transform data into a useful investment strategy.
- Advances in computing power, artificial intelligence, and machine learning capabilities are causing a proliferation of black box models in many professions, and are adding to the mystique surrounding them.
- Lets have a look inside….

The Black Box



A black box model receives inputs and produces outputs but its workings are unknowable.

Black box models are increasingly used to drive decision-making in the financial markets.

Beating the efficient market hypothesis

This sounds either impossible or illegal – “you can’t beat the market” – as this contradicts the efficient market hypothesis (EMH).

But EMH is wrong: there are hidden patterns that we can exploit, just about. But it takes lots of skill, cutting-edge ML, maths, data, and raw computing power.

All predictors can be represented mathematically – it really is a numbers game, and even in the present unusual circumstances: maths beats discretionary trading!

Being 51% right is enough – the law of large numbers is your friend!

Secrecy is key: the moment information leaks into the public domain, the trading signal quickly decays.

How do we use Machine Learning

Machine learning is core to our success: Machine learning is used by the bulk of our signals and is core to the past and future success of this business. If our ML models do not work, we do not make money

We keep up with the latest research and apply recent developments at scale: We are currently using techniques published in ICML and NeurIPS in production

While I cannot go into specifics, some general methods we use heavily are:

- Various deep learning techniques, transformers
- Bespoke large scale distributed training of non-linear tabular modelling methods
- State of the art Bayesian machine learning methods

How do we use Machine Learning

- A selection of current tools we use are: XGBoost, LightGBM, Tensorflow, Pytorch, GPFlow, GPyTorch, Numba, Dask, Ray, Horovod, Pytorch Lightning, Modin
- Signal research is broken down into teams: each team focuses on different techniques and data sources
- Thousands of features are shared between teams: there are inputs available to allow a machine learning researcher to be productive and hit the ground running from day 1
- Researchers work closely with embedded developers in collaborative teams: This ensures our researchers have the tools and support they need to be productive

How do we work?

Small Autonomous Teams

- Areas of specialisation, working on part of the big machine
- Lots of cross-collaboration

Focus on learning

- Long term development
- Machine learning College
- Reading Groups
- Conferences (ICML, NeurIPS)

Close Partnership with Engineering

Platform takes care of services – quants focus on research

100s of developers and IT staff working directly with research

Massive Compute Resource

- Almost 10k A100 GPUs
- Several 10s of PB storage
- Several 100k CPU cores

What do Quants do at G-Research?

Forecasting

typically financial assets, but could be data from satellite imagery, twitter feeds, traffic analysis……

Signals

we take multiple signals for a given financial instrument and combine them

Execution

in a dynamic marketplace full of sophisticated competitors, our quants continuously optimize the execution of trading strategies

The Typical Quant

- Is fresh from academia, in a maths, physics, stats, ML or data science related field
- Can articulate and test a hypothesis
- Has experienced real-world messy data
- Thinks creatively, is a problem solver
- Is motivated and self directed
- Has an aptitude for coding
- Has very little finance knowledge

What is needed?

- Strong maths foundation
- Calculus, Linear Algebra, Probability and Statistics
- Advanced programming skills
- Python inc libraries such as Numpy, pandas
- Data analysis techniques
- Time series analysis, Machine learning, Data manipulation
- Communications
- Hunger for learning

Small Grants Scheme

Every month we give away **£2,000** in grant money to early career researchers – and are especially interested in applications that are difficult to get funding for elsewhere (e.g. travel if you are caring for children; expenses for volunteer work related to your research).

How to apply?

Applying is easy: just send us an email at **grants@gresearch.co.uk** with your CV and a brief summary (no more than one page) of what you would use the grant for. You may include a letter of reference if you think it will help your case.

Spring into Quant Finance

- Hosted in the South of France (Nice)
- 5* hotel & £750 stipend
- All expenses included
- Hear talks about the industry
- Talk to our CEO and Directors of Research
- Undertake specialized training on ML, data science and finance
- Network with our Quant team

15th April to 19th April 2024

Summer Research Program

- 10 week programme June – August 2025
- Aimed at 2026 PhD/Masters graduates
- Project based internship

- You will be paired with a mentor working on a specific project
- Previous projects include:

  Exploring how uncertainty in trading volume predictions can in turn be used to trade more effectively

  Building a complex machine learning model to help predict upcoming earnings for businesses

Summer Research Program

Our interns gain hands-on experience with real projects, get access to leading training programmes and are partnered with a mentor for the duration of their time with us.

- Paid £3,750 per week
- Accommodation included
- Generous £2,000 stipend to spend on attending a conference, up to two years after internship
- Many social activities

Permanent positions

www.gresearch.com/vacancies/

- Starting salary of £200,000
- Annual discretionary bonus
- 35 days annual leave
- 9% Employer pension contribution

- Free lunches
- Full company social calendar
- In-house barista
- Informal dress code and excellent work/life balance