# DSR ROADMAP

Lucas Aresin

DATA SCIENCE RETREAT®

SINCE 2014

# AGENDA

INTRO ROUND — Let's get to know each other

*Short break*

THE DSR ROADMAP — What is the journey ahead like?

*Short break*

HANDS-ON — Set up a very simple data science project repo on GitHub

*Short break*

RESOURCES & QUESTIONS — Ask me anything + helpful links and tools

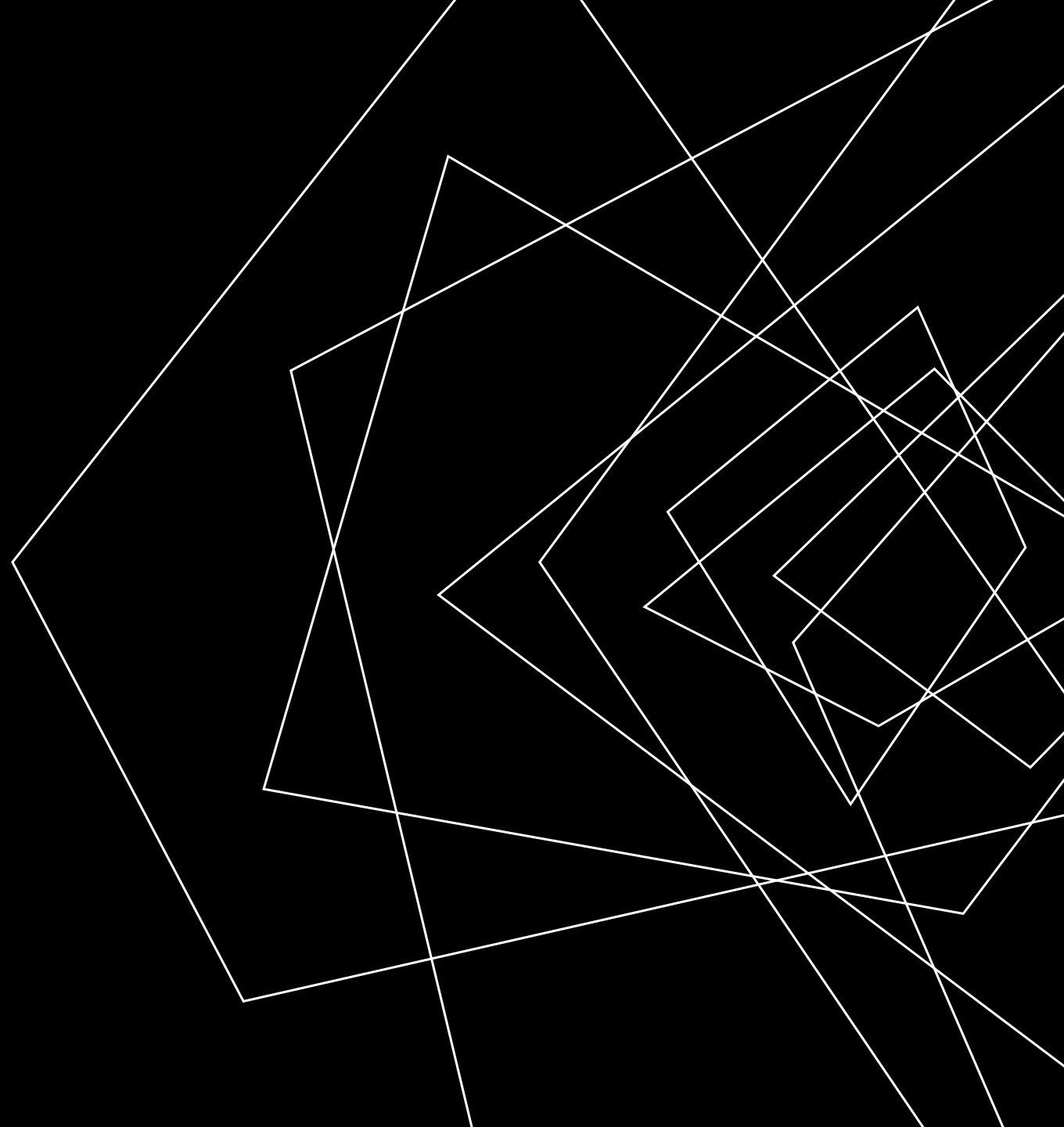
# ABOUT ME

A self-taught data science and machine learning enthusiast. Speaks Java, JavaScript, Python, Kotlin.

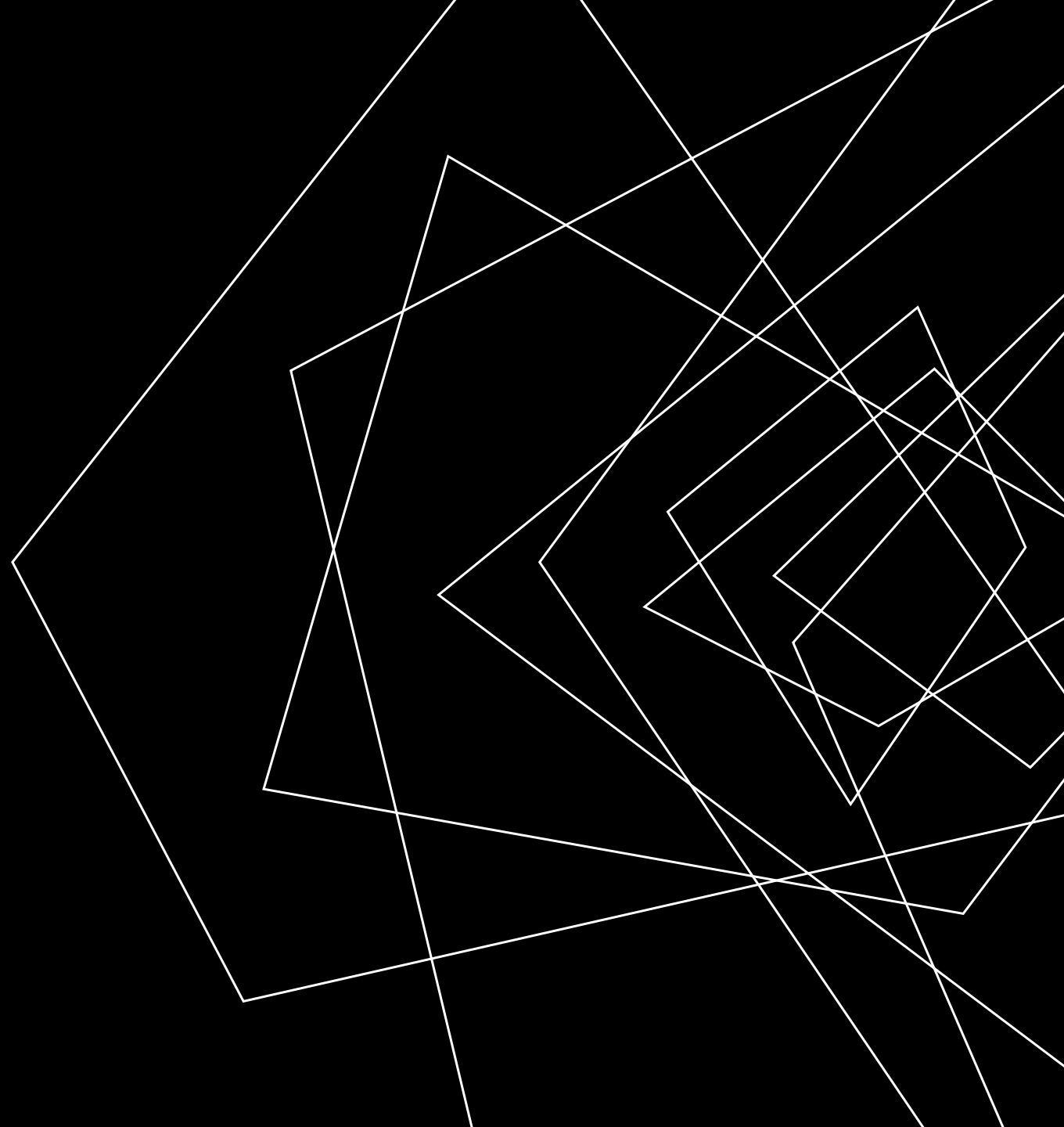
I didn't understand how machines learn, so I learned how machines learn.

Professional data scientist and machine learning engineer at ams OSRAM.

- Ask me anything
- Speak up if you don’t like something
- Contact me on LinkedIn



# WELCOME BATCH 43!



# AND WHAT ABOUT YOU?

Your name

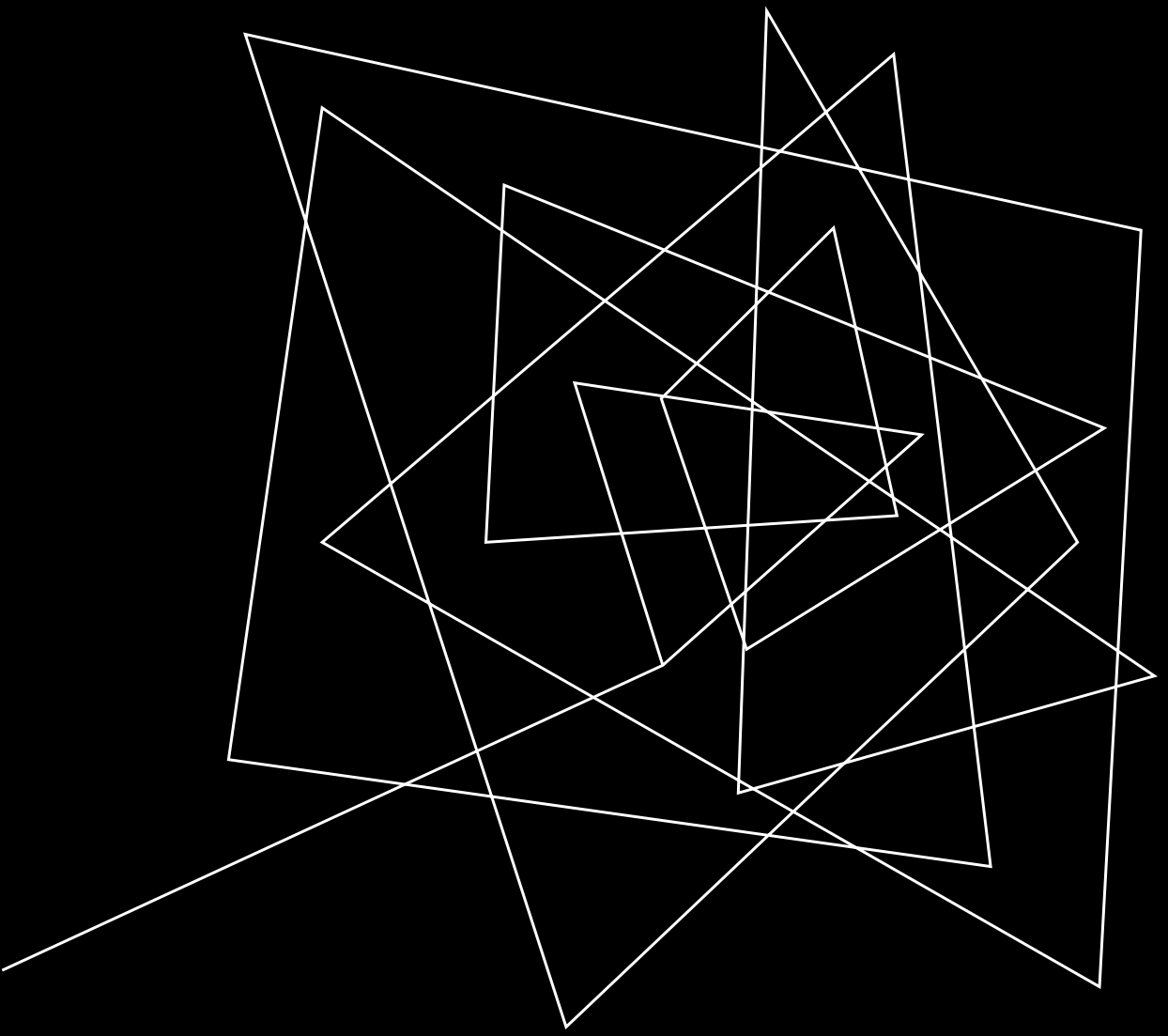
Your background

Why you came here

(and, if you'd like to share, your largest knowledge gap)

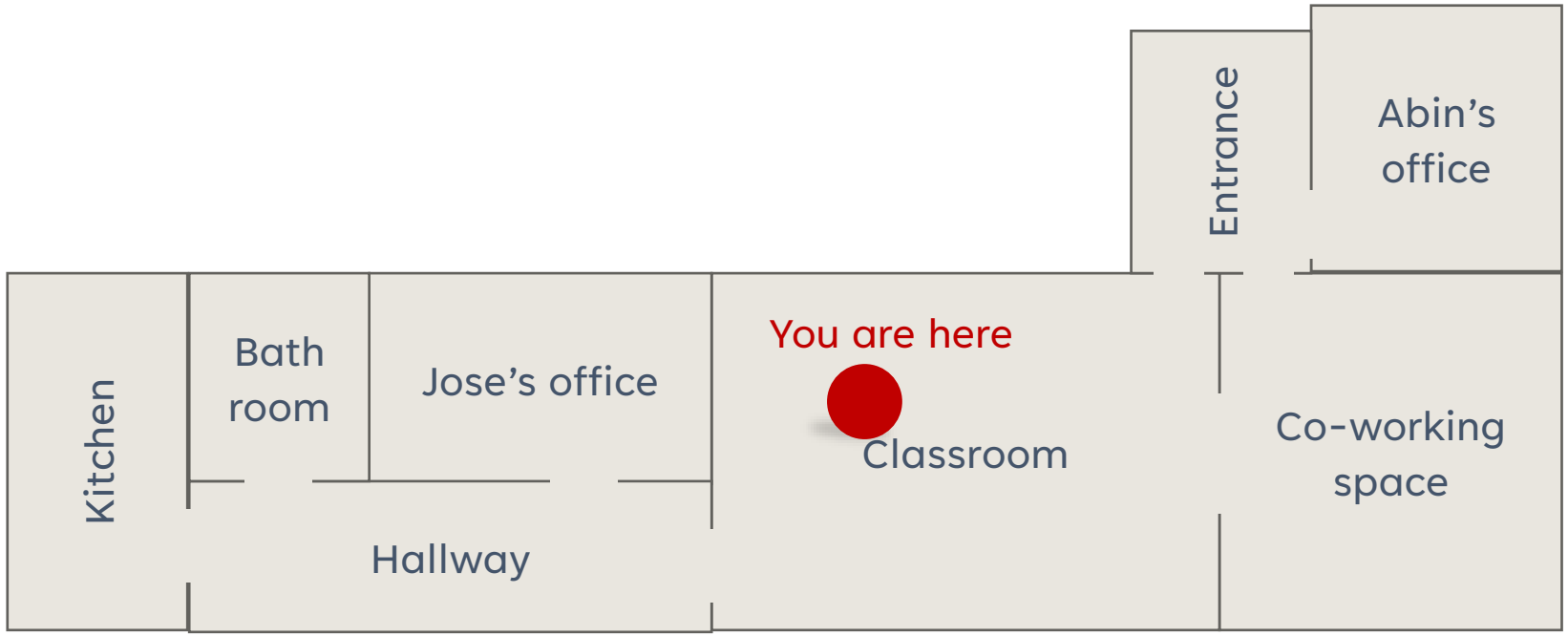
Hopes and dreams

(and, if you'd like to share, a book recommendation)



# DSR ROADMAP

# THE RETREAT


Entrance
Abin's office
Kitchen
Bath room
Jose's office
You are here
Classroom
Co-working space
Hallway

# THE TEACHERS

## INDUSTRY PROFESSIONALS

- Practical, up-to-date knowledge
- Less theory, more practice

## SOME ARE DSR GRADUATES

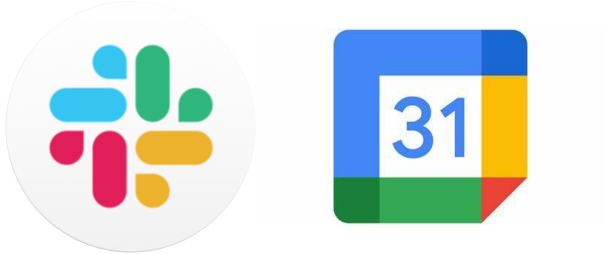
- They know what it’s like
- Ask them about their projects!

## THEY ARE PEOPLE TOO ☺

- Working on weekends
- Teaching while having a full-time job

# LET’S GET SOME ADMIN OUT OF THE WAY

## COMMUNICATION TOOLS



## CLASS GUIDELINES

- Classes are from 09:30 to 17:30.
- Please be on time.
- Be prepared.

## LECTURE ATTENDANCE

- If possible, be here in person
- Let people know when you are not coming

# LET’S GET SOME ADMIN OUT OF THE WAY

## “FREE” DAYS

- Project work
- Prepare and reflect
- 1:1s with Jose (later)

## FEEDBACK

- Communicate!
- Abin is always available

## COURSE MATERIALS

- It can be a lot
- Don’t be overwhelmed
- Use it as your own knowledge base

# DSR ROADMAP IN A NUTSHELL

1 TECHNICAL FUNDAMENTALS

2 DS AND ML FUNDAMENTALS

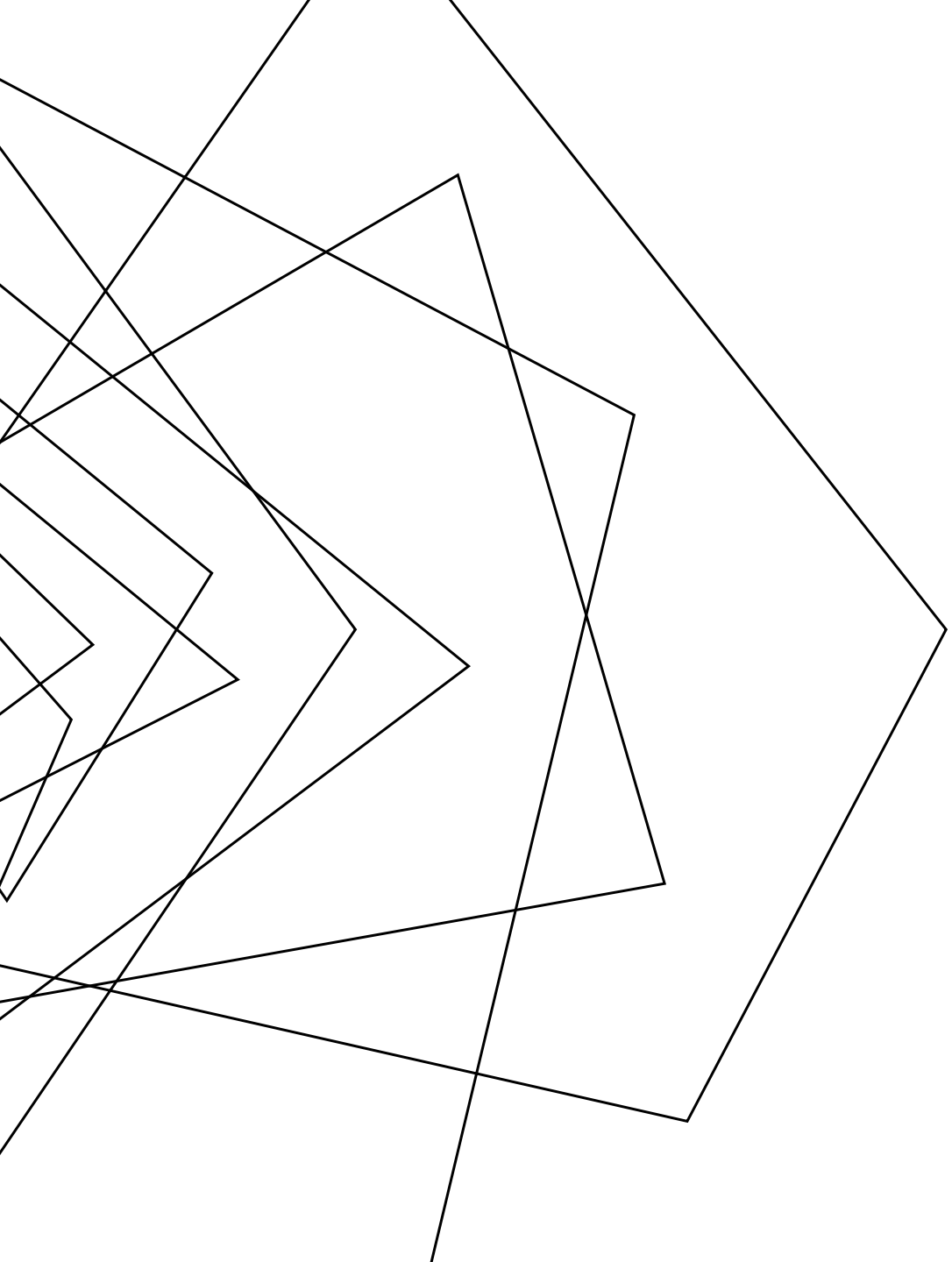
3 MINI COMPETITION

4 DEEP LEARNING / GENERATIVE AI

5 PRACTICAL DATA SCIENCE

6 SOFT SKILLS

7 THE PORTFOLIO PROJECT & DEMO DAY



# 1 TECHNICAL FUNDAMENTALS

## DEV TOOLKITS AND ENVIRONMENTS

Git, Bash, Docker, Databases

## PROGRAMMING AND DATA ANALYSIS

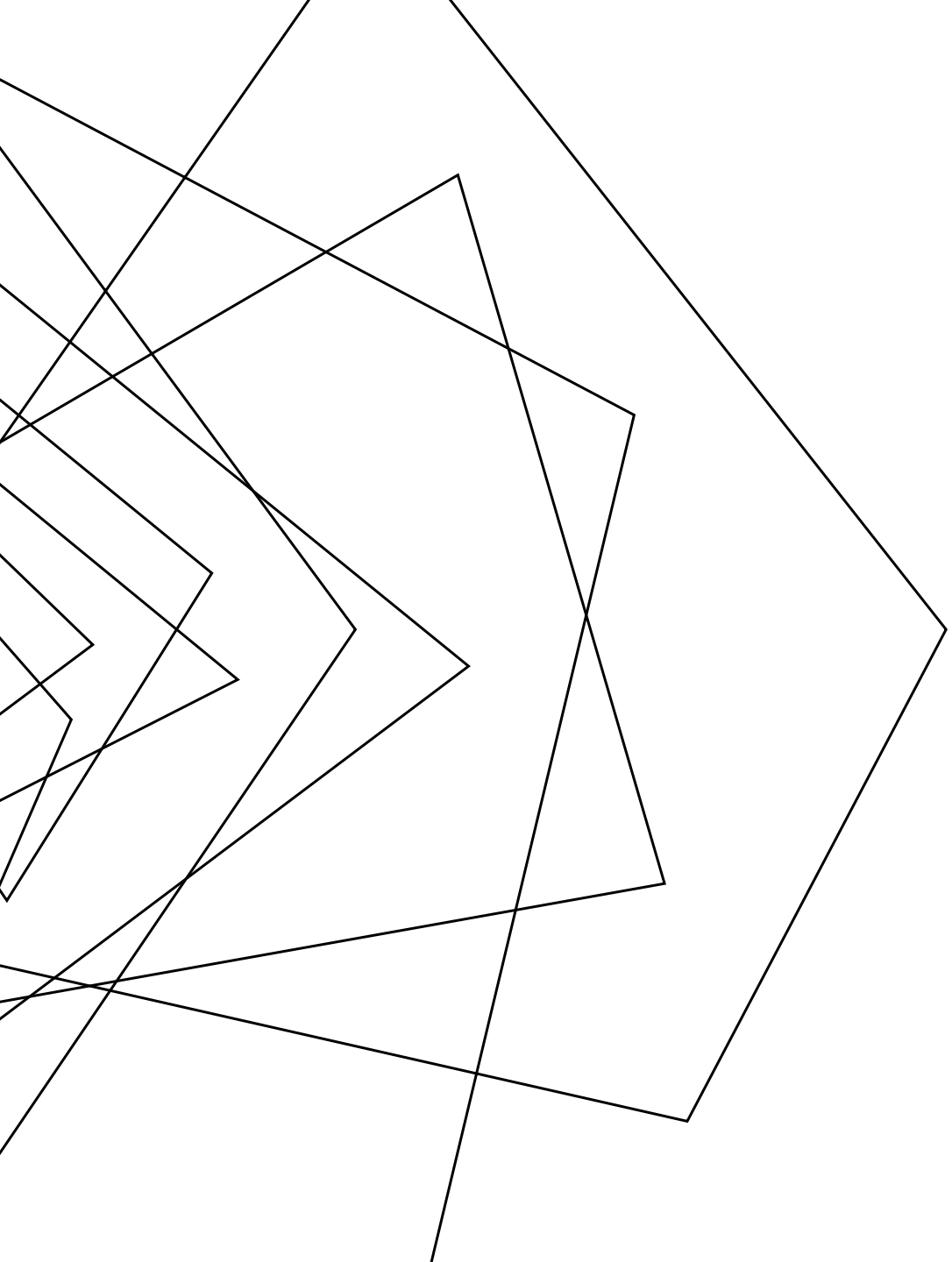
Python, NumPy, Pandas, SQL

## SCARY MATH

Probability & Statistics

## PRESENTATION

Data visualization (Example)



# 1 TECHNICAL FUNDAMENTALS

## DO NOT UNDERESTIMATE THESE THINGS

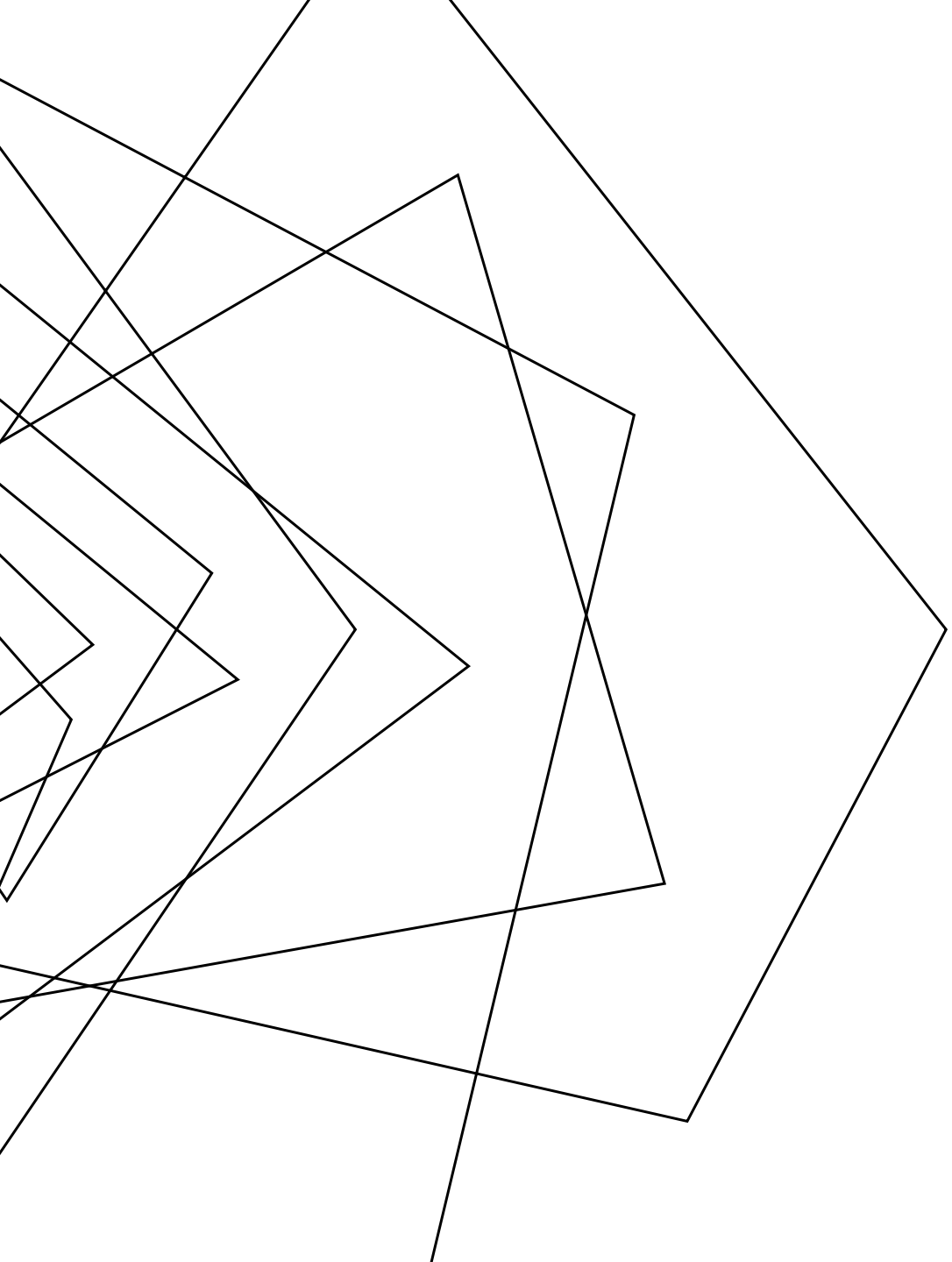
- The foundation for everything else
- It will be hard to perform well without them

## USEFUL LITERATURE

- Data Wrangling with Python (Jacqueline Kazil, Katharine Jarmul)
- Python for Data Analysis (Wes Mckinney)

# THE FIRST TWO WEEKS

| **June / July** | Mon 23 | Tue 24 | Wed 25 | Thu 26 | Fri 27 | Sat 28 | Sun 29 | Mon 30 | Tue 01 | Wed 02 | Thu 03 | Fri 04 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Topics** | Intro | Numpy Pandas | Git Bash | Proba-bility | SQL | - | - | Stats | DS Fundamentals | ML Fundamental | | Data Visualization |



# 2 DS AND ML FUNDAMENTALS

## ML FUNDAMENTALS

How do machines learn? What are performance metrics? What is possible / not possible? Three types of learning.

## OBJECT-ORIENTED PROGRAMMING

Objects & classes. Logging and error handling. Unit tests.

## DS FUNDAMENTALS

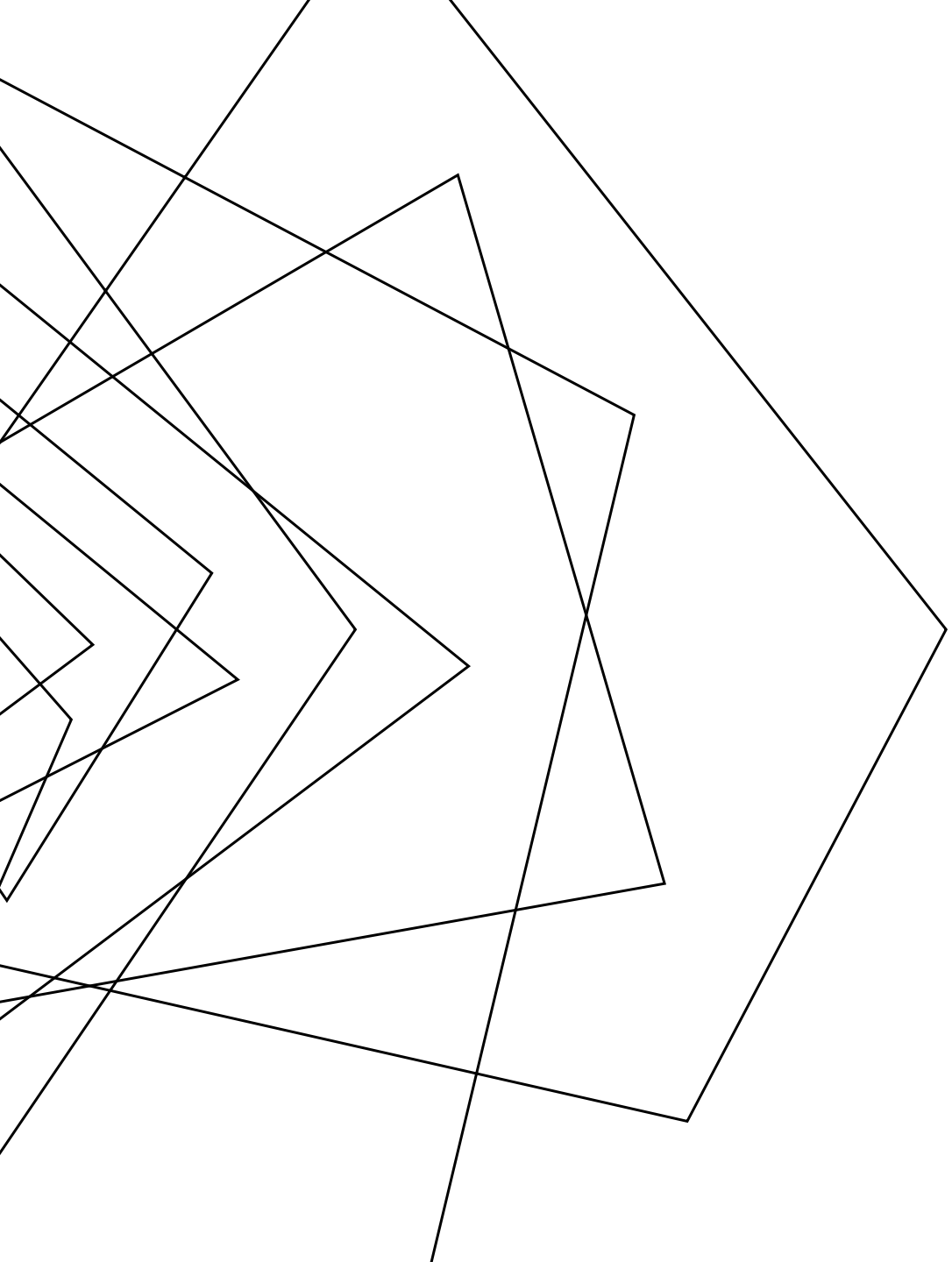
Develop a structured idea of the data science workflow. Implement a small example project. Data wrangling and model building.

## TREES

Foundational tree models for classification / regression on tabular data. Bagging & Boosting.

## TIME SERIES

Model changes over time. Forecasting. Decomposition, seasonality, trends and detrending. ARIMA, Holt-Winters method.



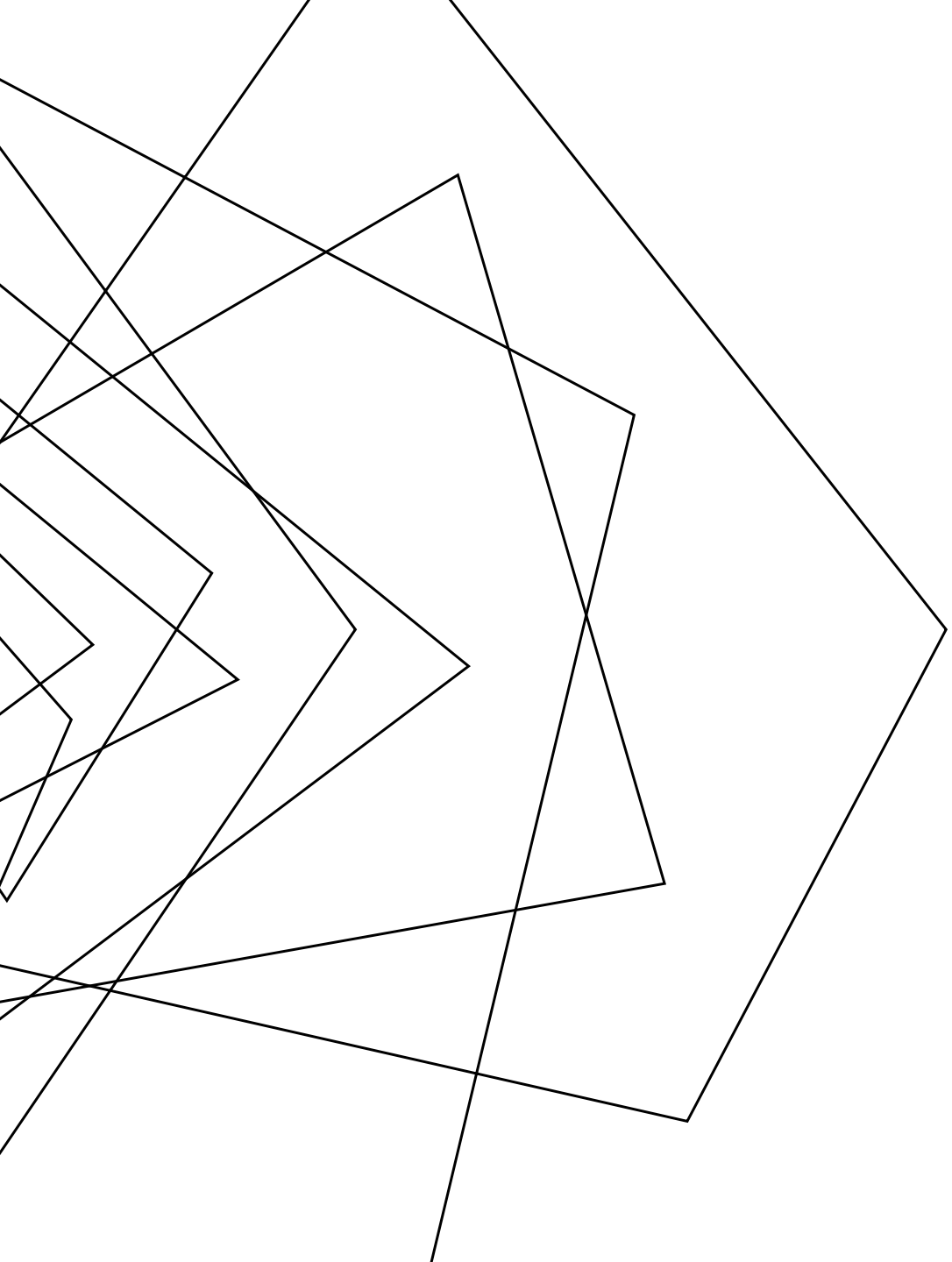
# 2 DS & ML FUNDAMENTALS

## YOUR DATA SCIENCE TOOLKIT

- The key points required to pass an interview
- Day-to-day operations in data science
- Go through the notebooks if possible
- Practice these skills on Kaggle

## USEFUL LITERATURE

- The Elements of Statistical Learning (Jerome H. Friedman, Robert Tibshirani, & Trevor Hastie)
- Data Analysis and Data Mining: An Introduction (Adelchi Azzalini & Bruno Scarpa)
- Towardsdatascience.com articles



# 3 MINI COMPETITION

## 3 DAYS OF REAL DATA SCIENCE WORK

Put your skills to the test and aim for the high score.

## WORK IN TEAMS

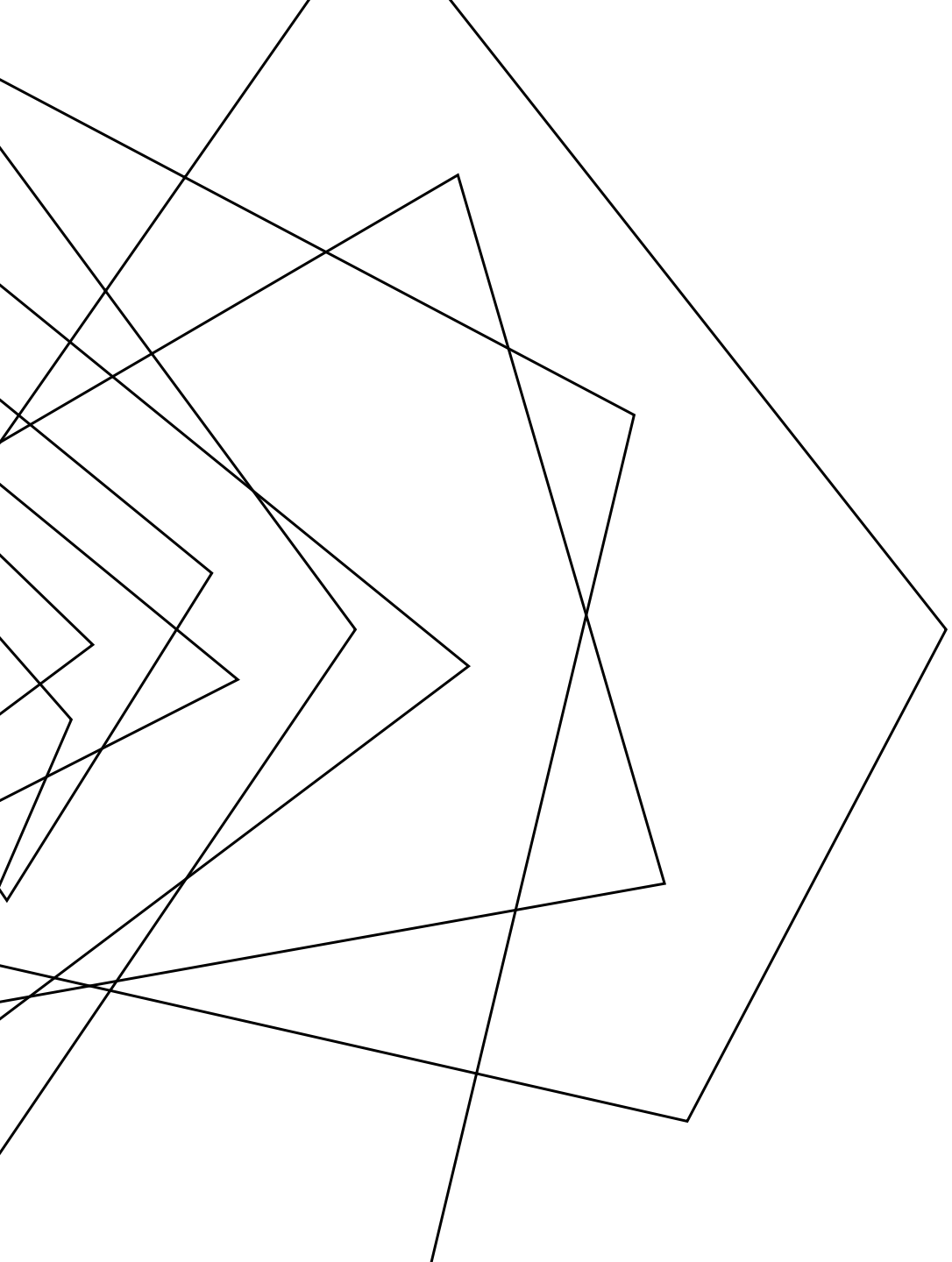
Collaboration is key. Remember your GitHub knowledge.

## BUILD A CLEAN REPOSITORY

A high score is nice, but what matters is nice, clean code.

## HAVE FUN!

Order in some pizza and stock the shared fridge.



# 4 DEEP LEARNING

## FUNDAMENTAL DEEP LEARNING

BACKPROPAGATION! Neural Network architecture. Complexity theory.

## POPULAR FRAMEWORKS

Tensorflow & PyTorch, mainly

## TECHNIQUES AND FRAMEWORKS

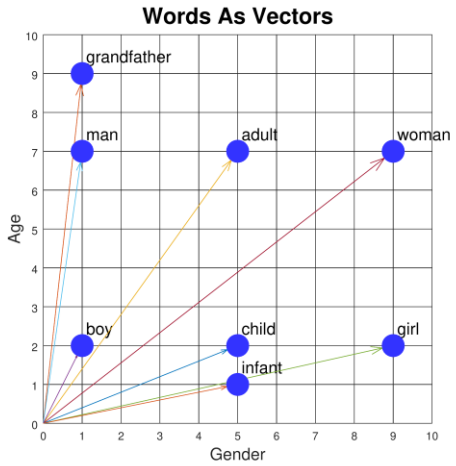
NLP, transfer learning, representations, image processing, computer vision, geometric deep learning, reinforcement learning. And, of course, the mythical transformers.

## ADVANCED TECHNIQUES

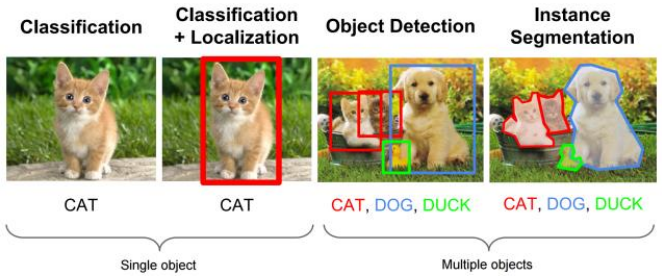
Debugging Deep Learning Models. Finetuning LLMs. RAG (Retrieval augmented generation).

# 4 DEEP LEARNING

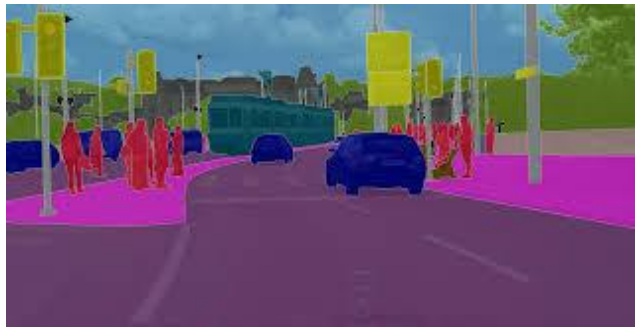
## WORD EMBEDDINGS

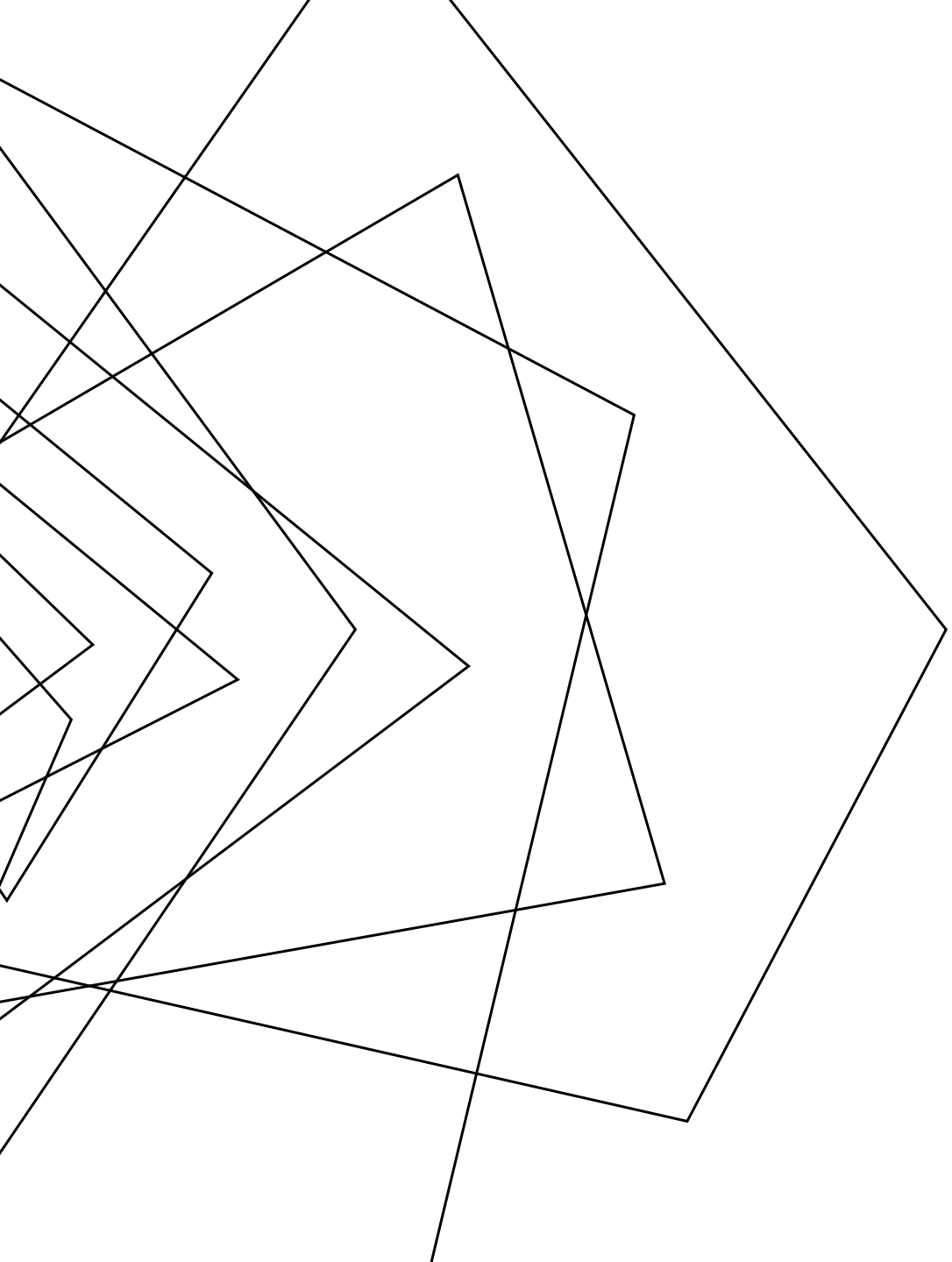



## IMAGE CLASSIFICATION




## SEMANTIC SEGMENTATION





# 4 DEEP LEARNING

## HERE'S WHERE IT GETS REALLY FUN

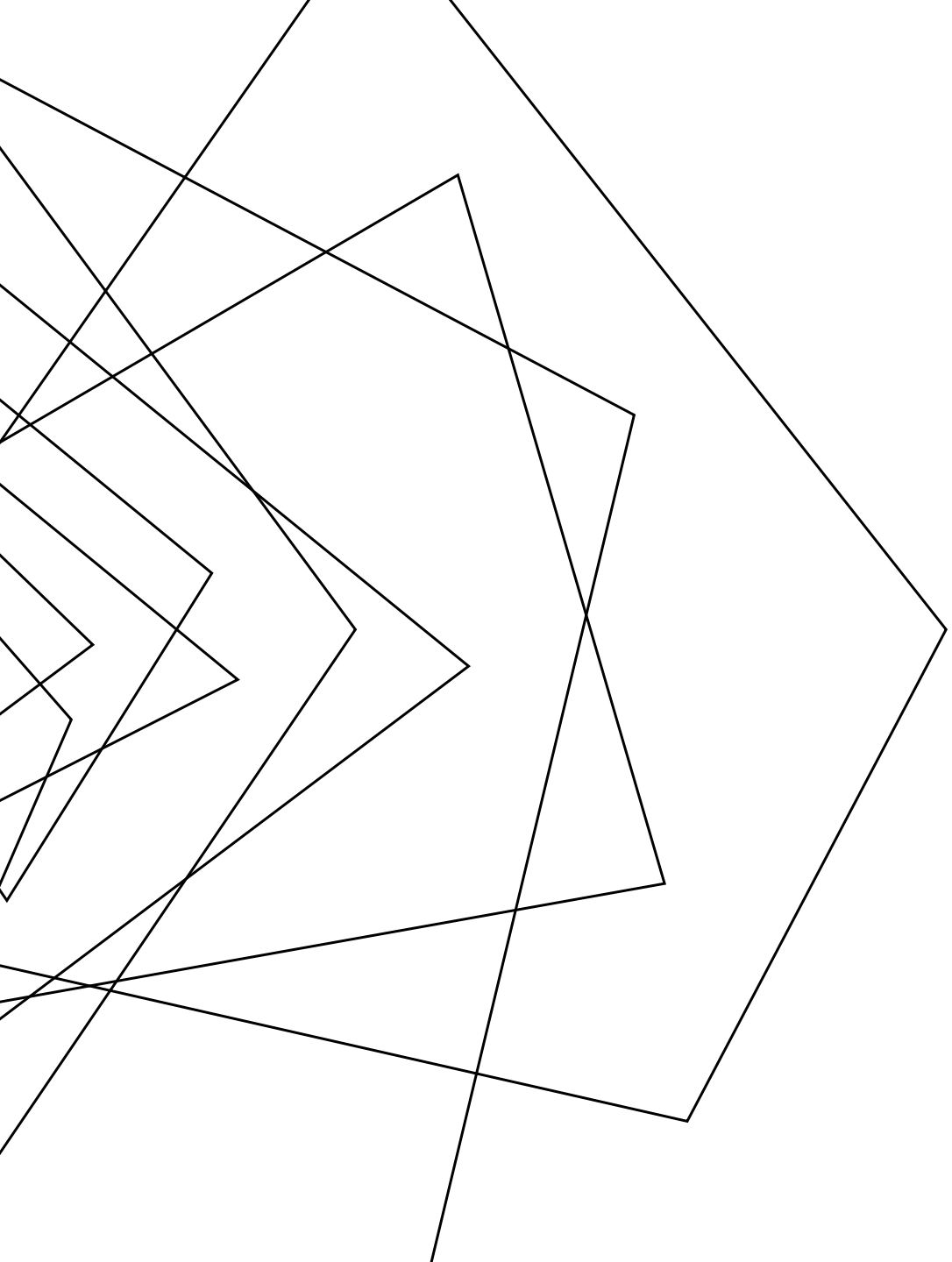
Building a GPT from scratch or designing your own RAG solution is very rewarding and builds deep understanding.

## USEFUL VIDEOS

- Neural Network series by 3Brown1Blue

## USEFUL LITERATURE

- Deep Learning (Ian Goodfellow, Yoshua Bengio, Aaron Courville) – THE BIBLE of deep learning
- Deep Learning with Python (François Chollet)
- Set a GPU on AWS
- Set a GPU on Google Cloud



# 5 PRACTICAL DATA SCIENCE

## ML OPS

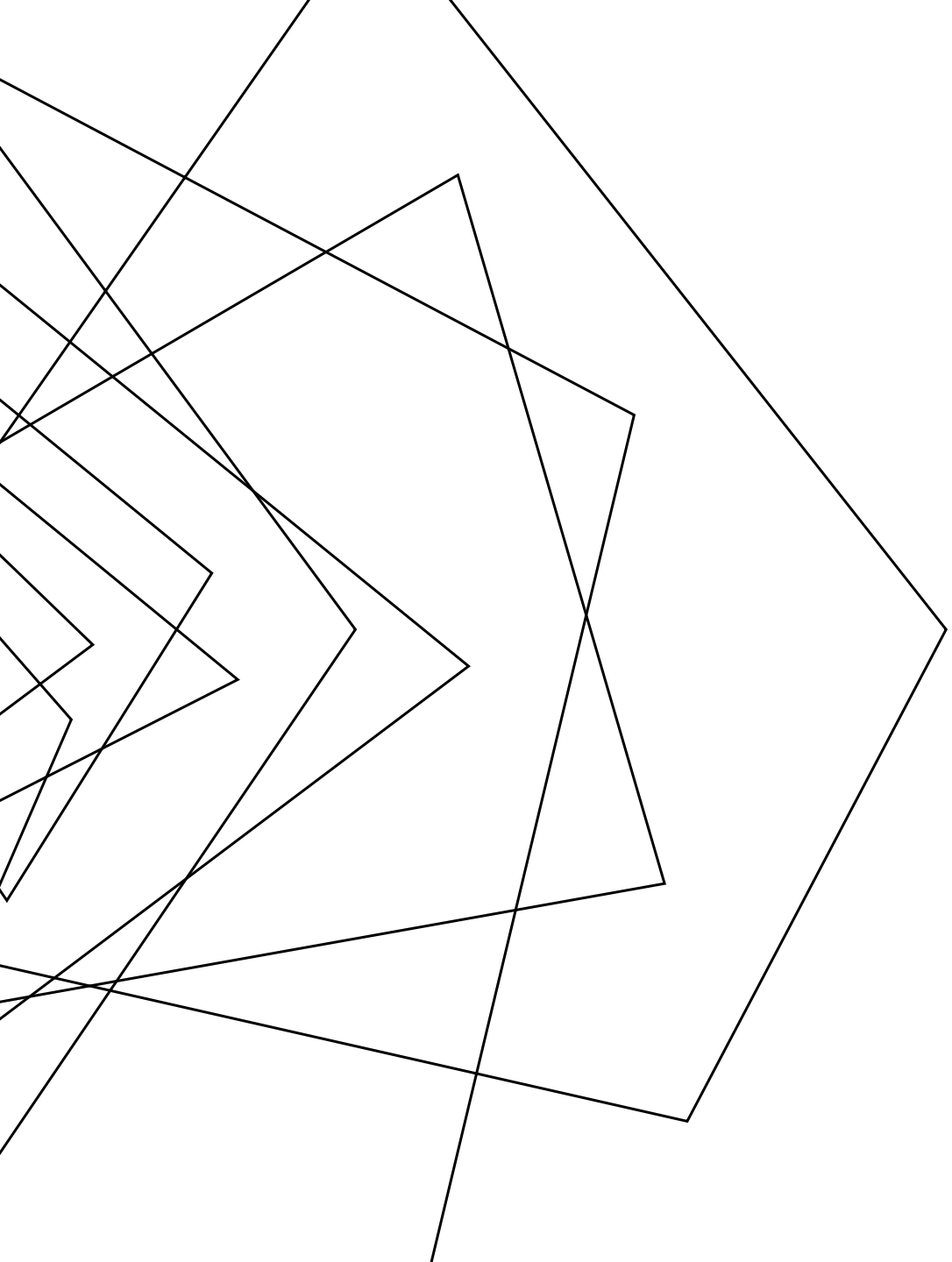
From training to deployment to API – bring your machine learning to life!

## TEST-DRIVEN DEVELOPMENTS

Avoid catastrophic mistakes by writing good tests!

## PRACTICAL DS WITH STREAMLIT

Build a useable application in minutes in Python.



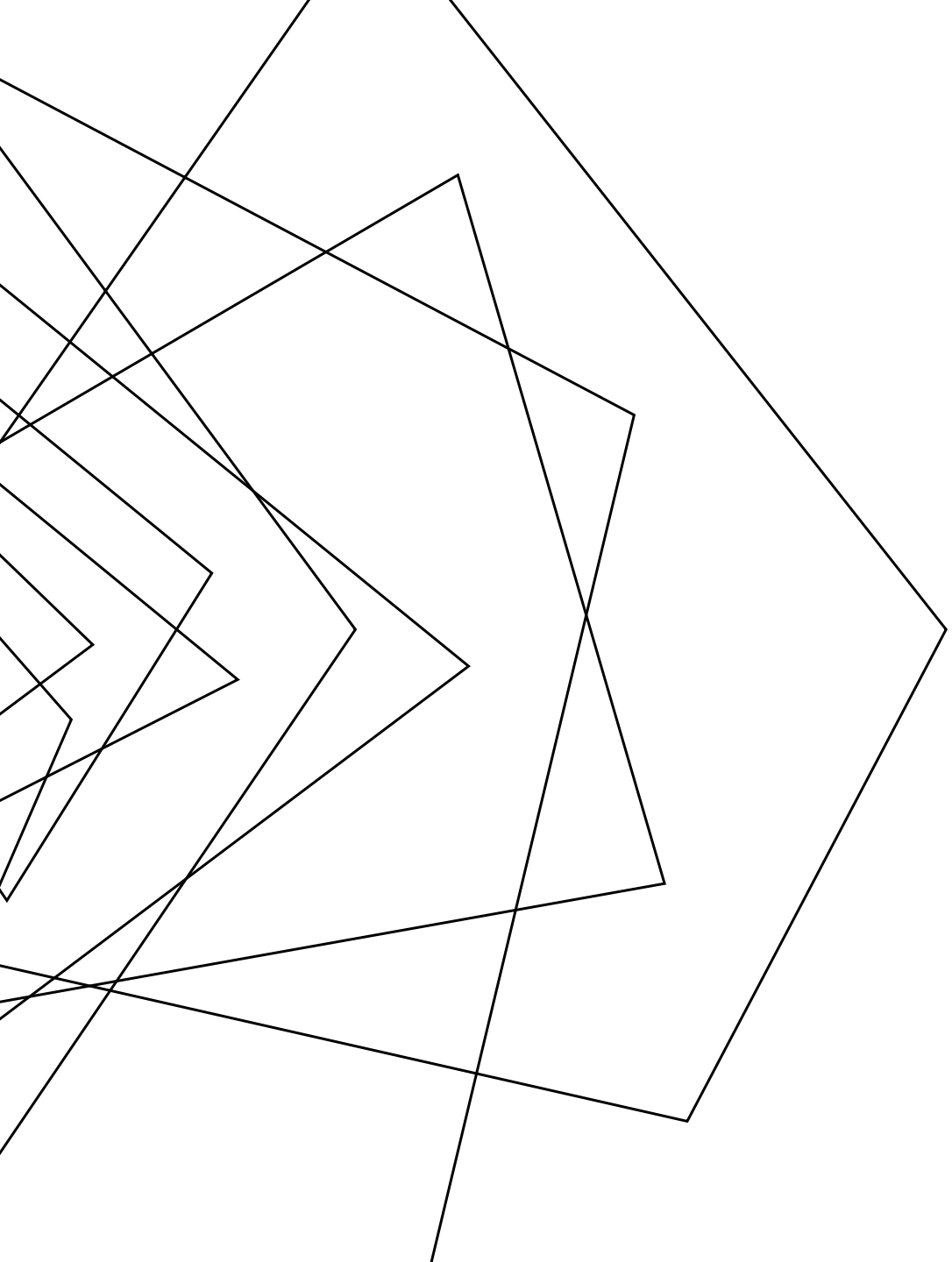
# 5 PRACTICAL DATA SCIENCE

## CARRY YOUR MODELS INTO THE WORLD

Nice code in a Jupyter notebook is worth nothing if it’s not deployed and usable. Here you learn how to get things out there!

## DO NOT MISS THESE CLASSES

- Highly applicable in real life
- Not as flashy as building a GPT, but very real and useful
- Immensely useful for portfolio project



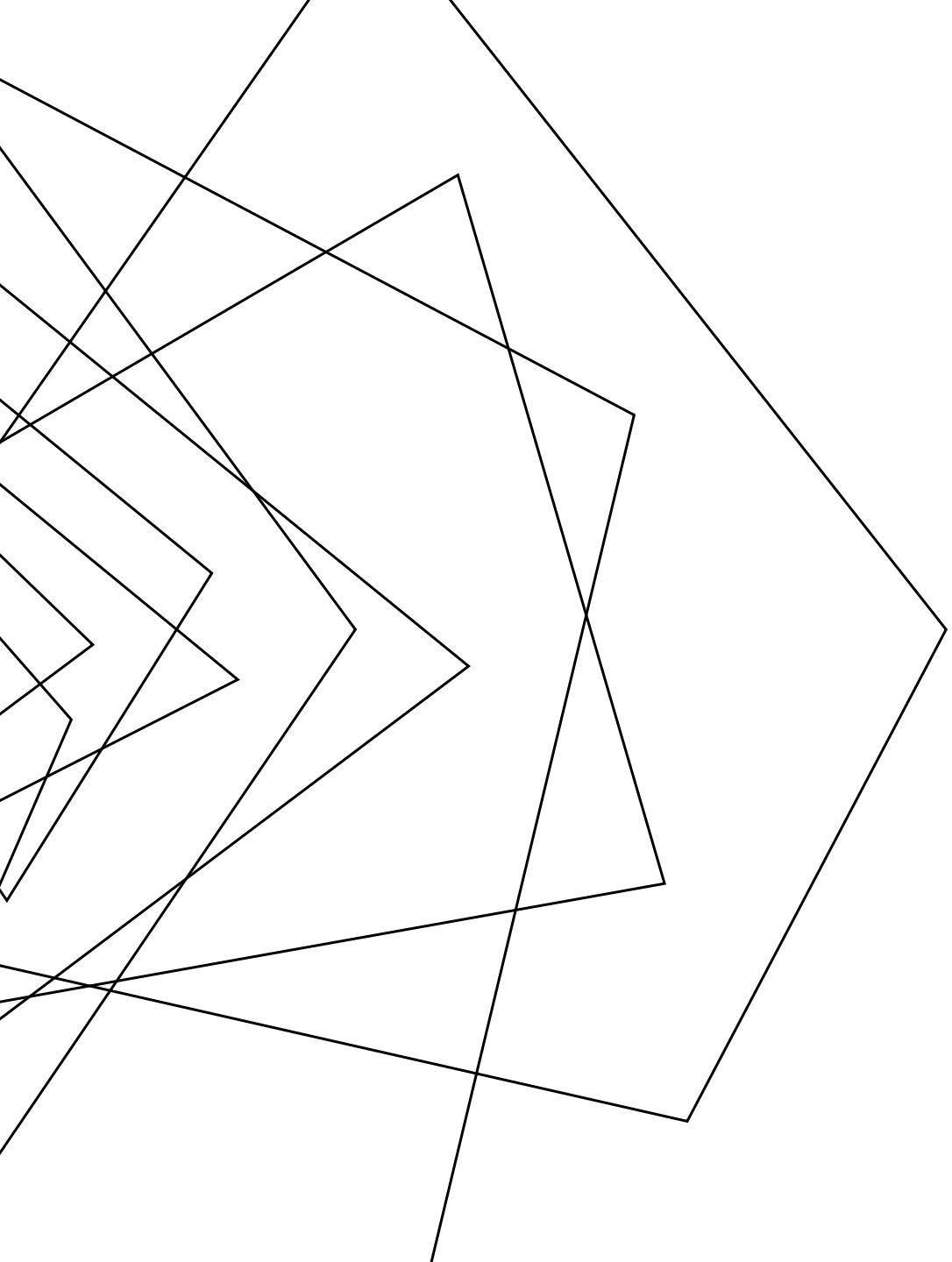
# 6 SOFT SKILLS

## BUSINESS COMMUNICATION

Talk to stakeholders. Explain difficult concepts. Manage expectations. Nail that interview.

## CAREER SUPPORT

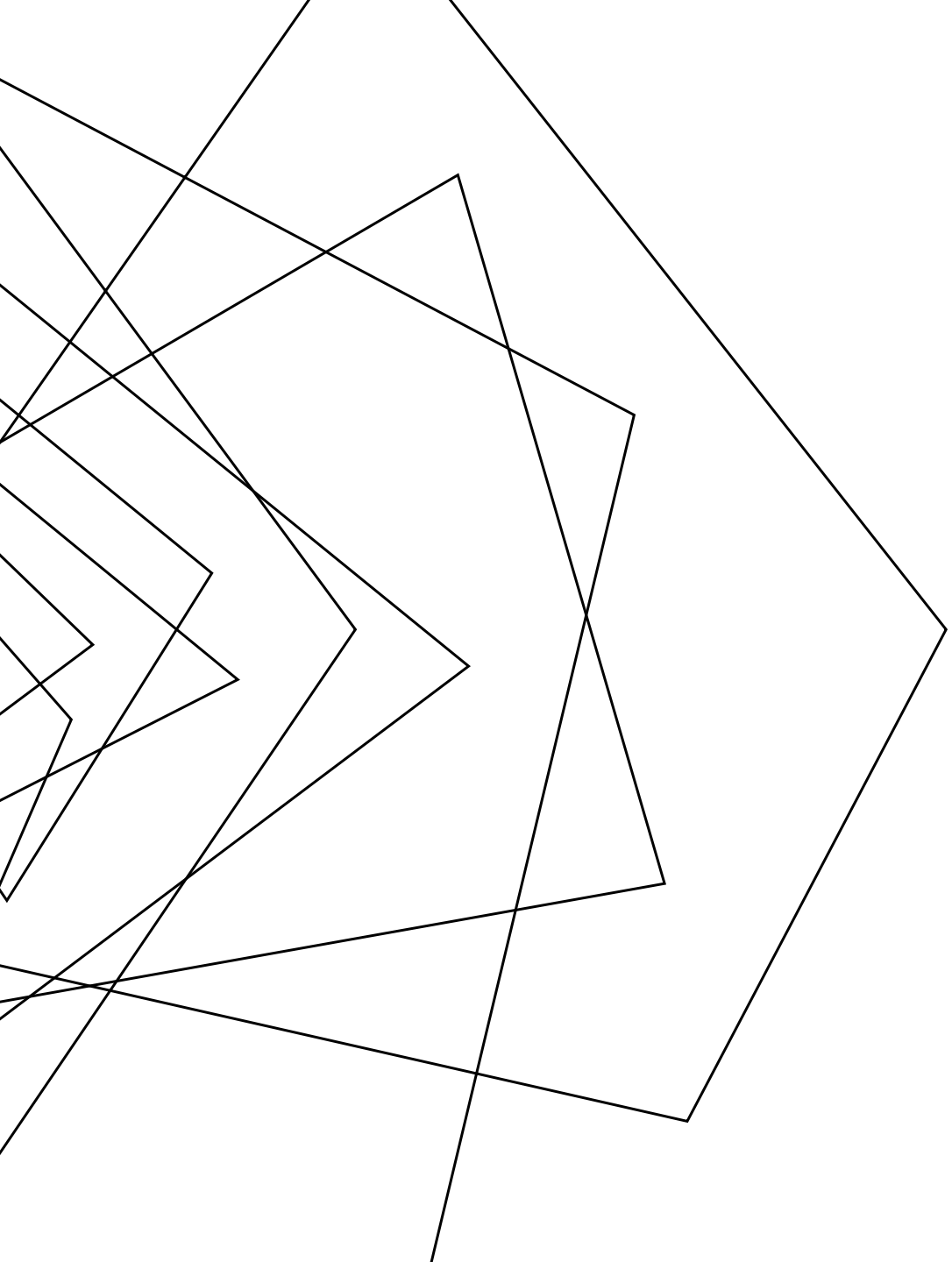
How to land a job in data science.



# 6 SOFT SKILLS

## COME PREPARED

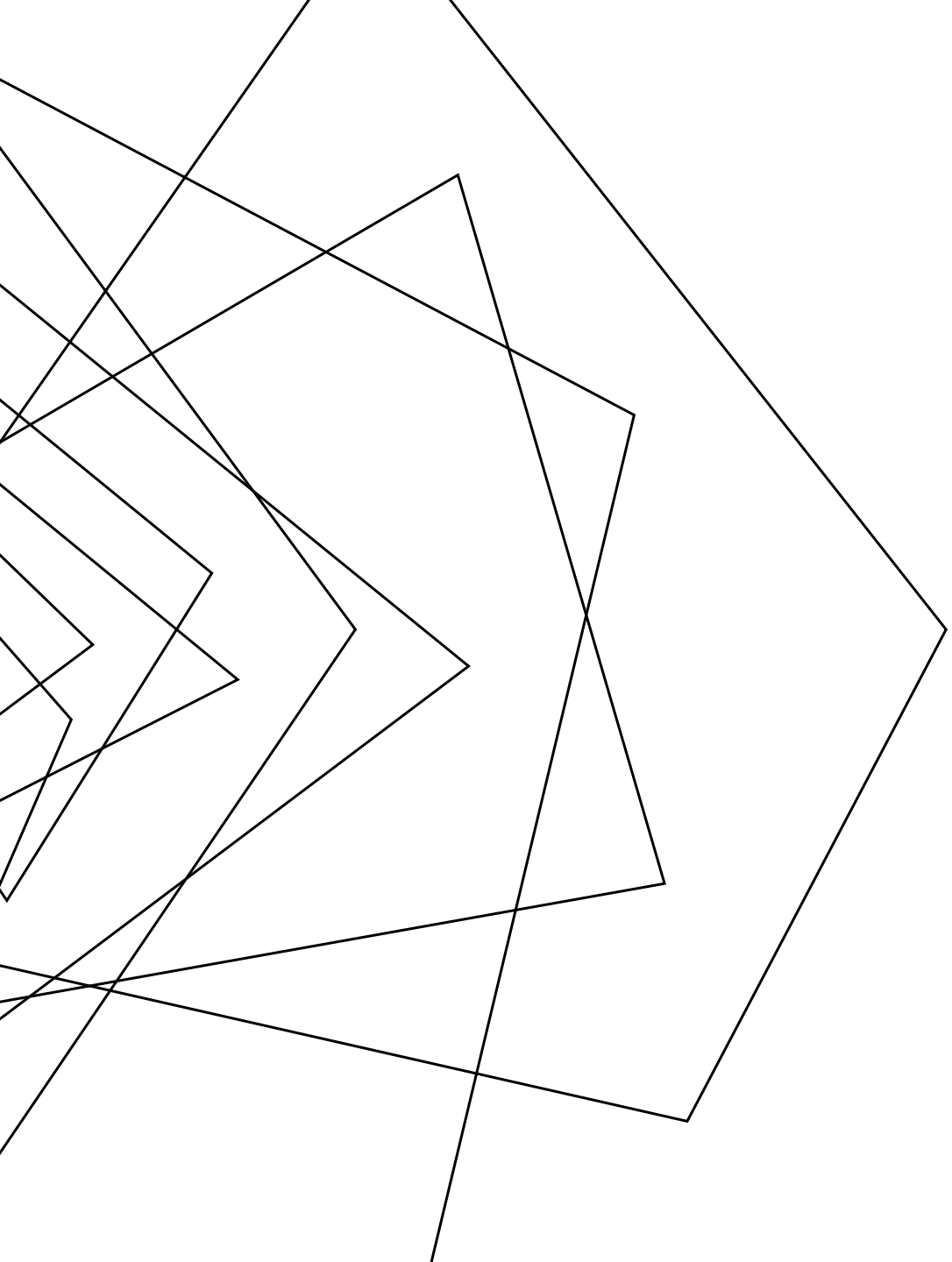
- For the communication class, pick a topic / situation that you found challenging in the past.
- For the career support class, prepare your CV



# 7 THE PORTFOLIO PROJECT

## THIS IS WHERE IT GETS REAL!

- Find a problem
- Turn it into a data problem
- Find, create, retrieve and prepare data
- Deliver a result and present it



# 7 THE PORTFOLIO PROJECT

SHOWCASE WHAT YOU LEARNED

IDEALLY A TOPIC YOU FIND INTERESTING

WORK ALONE OR IN TEAMS

TIME MANAGEMENT

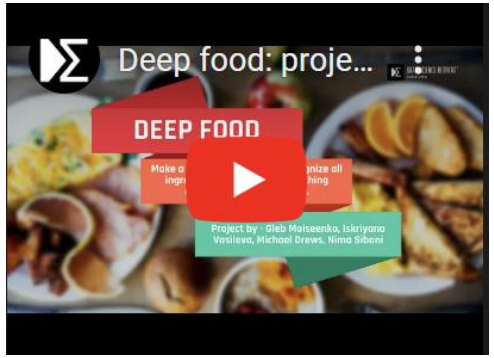
# SOME COOL EXAMPLES


The sound of failure

Batch 25


Medical Advice Generator

Batch 34




Deep Food

Batch 22


Enhance doctors (not replace them)

Batch 34

# STARTING POINTS

## PAPERS WITH CODE

- Paperswithcode – it will provide you with trending machine learning research and the code to it

## TECH & BUSINESS MAGAZINES

- MIT Technology Review
- The Economist
- Harvard Business Review

## DISCUSSIONS

- With humans
- With ChatGPT or your local flavor

# THERE IS NO SILVER BULLET

FINDING YOUR TOPIC IS HARD

BE AMBITIOUS BUT REALISTIC

DON’T ONLY LOOK BACK – ALSO LOOK AHEAD

START THINKING NOW

# THE PERFECT PROJECT

*It makes you want to code late into the night*

EXCITING

APPROVED

*It got Jose's blessing*

???

CHALLENGING

*It lets you apply your skills*

AMBITIOUS

*It sets the bar high and impresses the audience*

# EVEN MORE ADVICE

## COMMUNICATE EARLY

- Attend the project workshops and use the 1:1 sessions!
- Provide a 1-paragraph description to Arun when you have a topic

## MENTORS WILL SUPPORT YOU

- Teachers can mentor a project
- We try to match mentors to the topic
- Typical mentoring days are Mondays & Thursdays

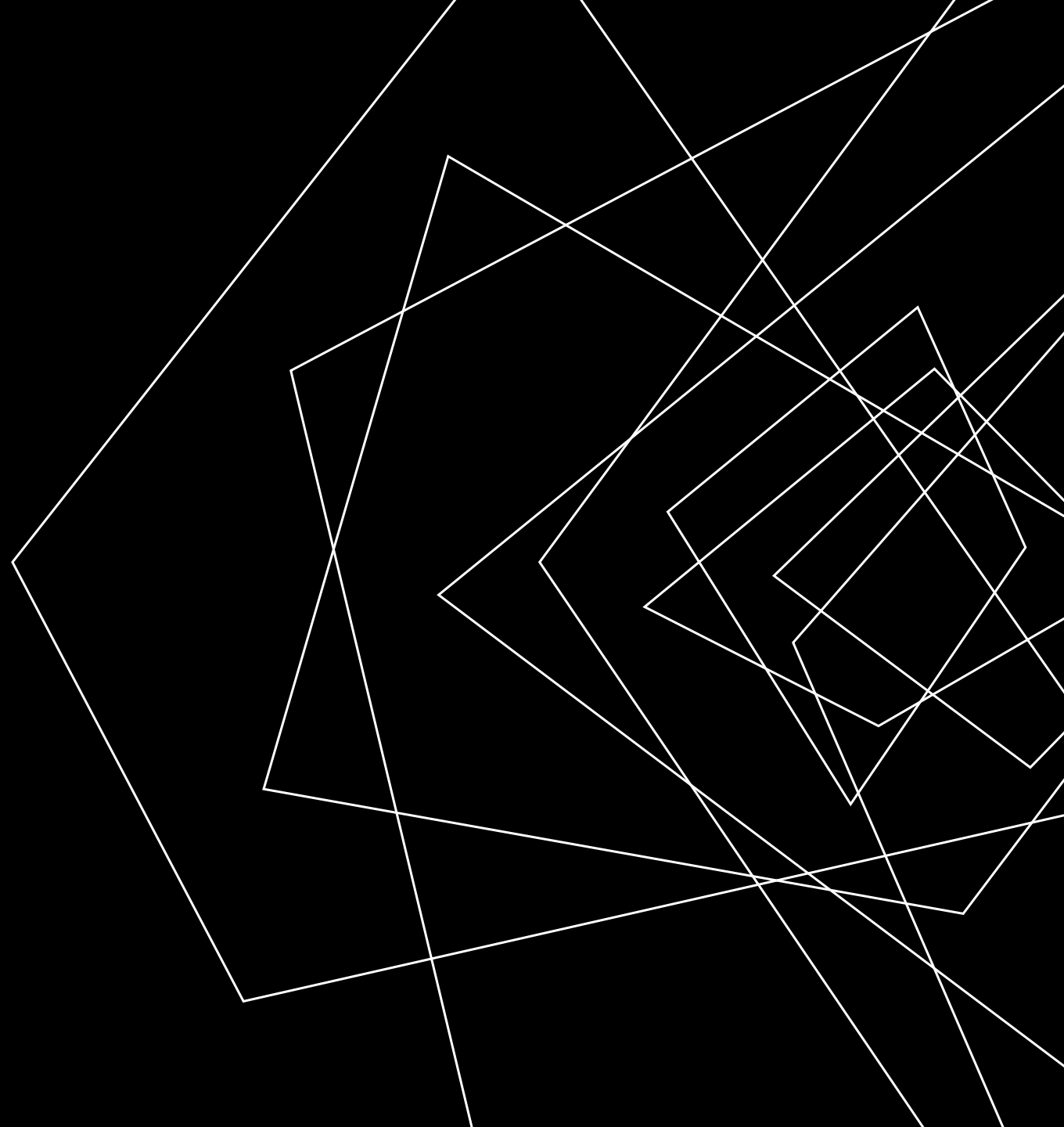
## WHERE?

- You can be flexible – at home or at DSR

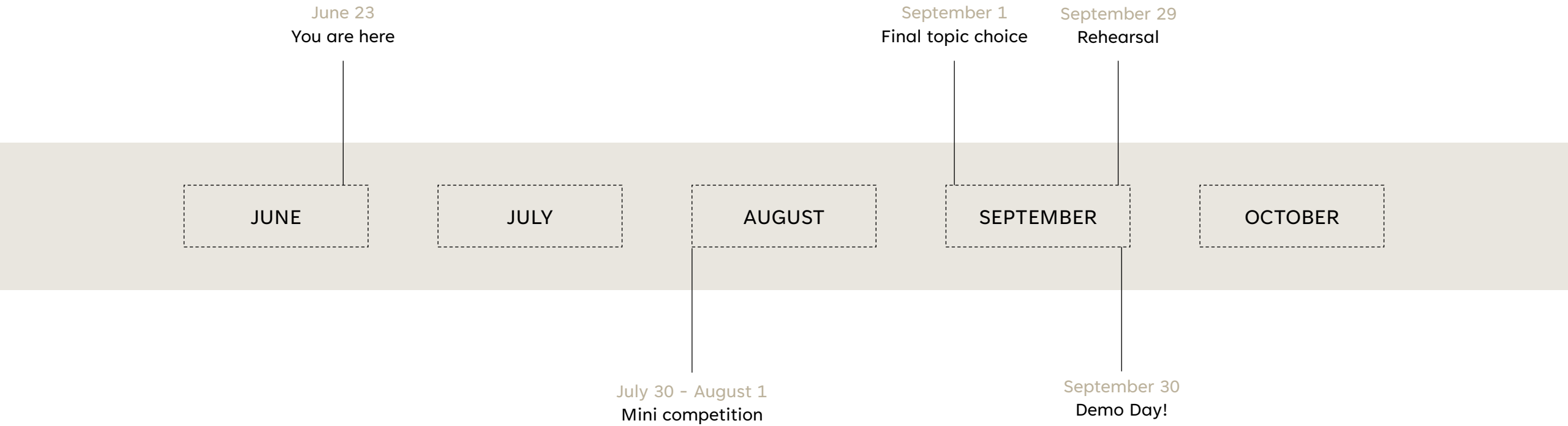
# QUESTION: CAN I USE GENERATIVE AI ?

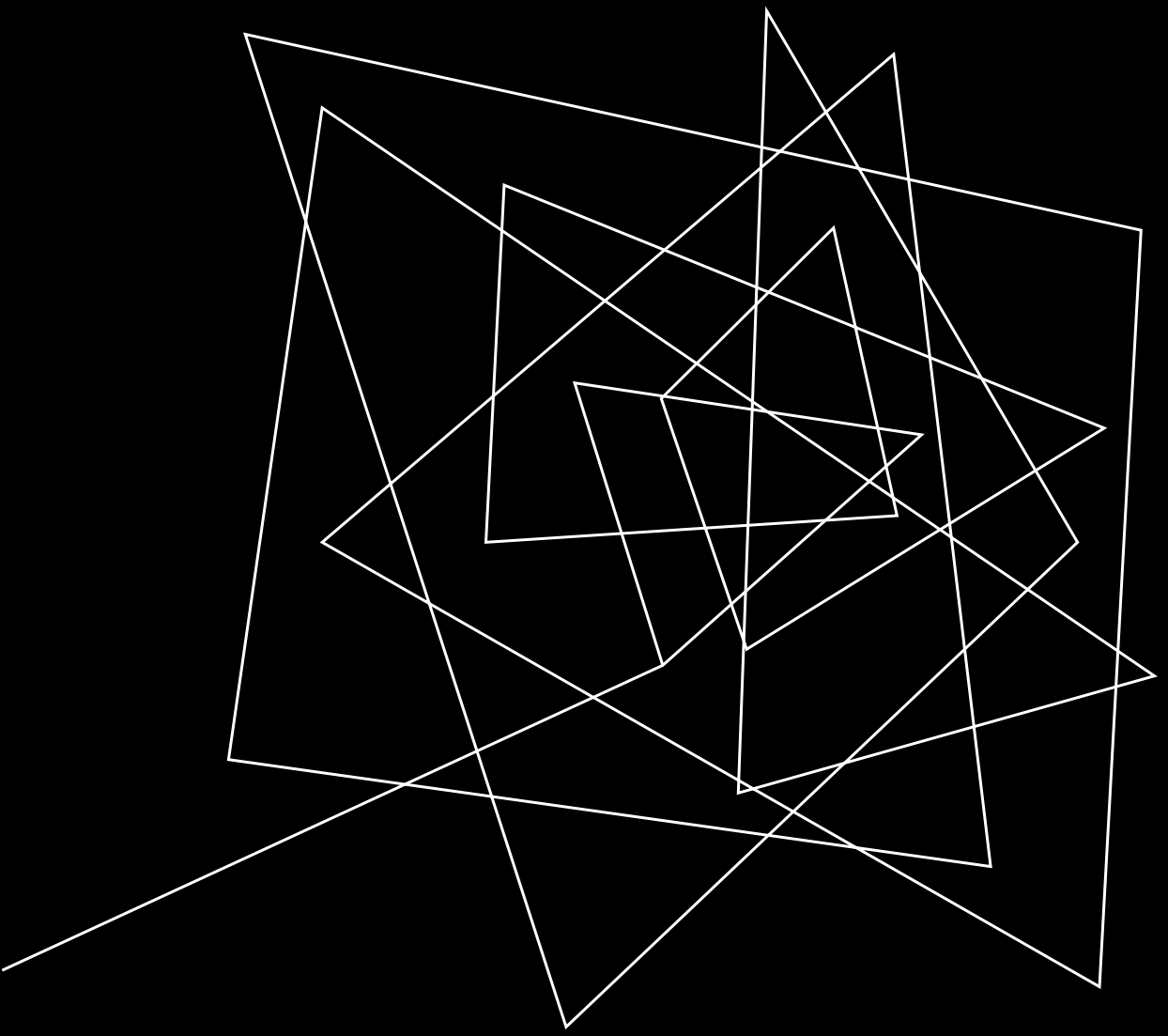
- Yes (to an extent)
- Resist the temptation (sometimes)
- Use it to learn, don't use it to skip

- Look into GitHub Copilot



# MILESTONES


June 23
You are here
September 1
Final topic choice
September 29
Rehearsal
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
July 30 - August 1
Mini competition
September 30
Demo Day!



# SOFTWARE SETUP

# THE SHELL

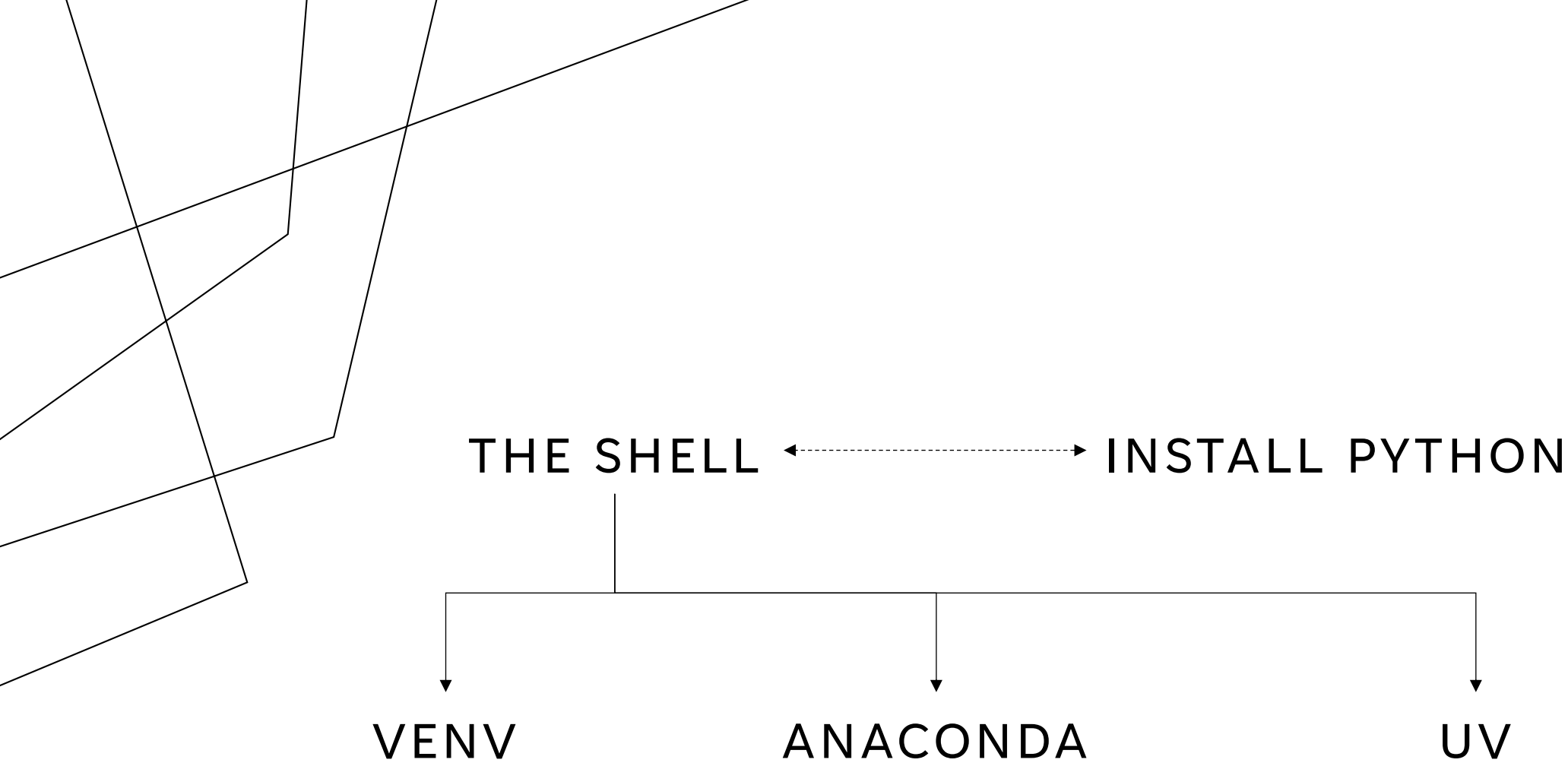
## USER <> OPERATING SYSTEM INTERFACE

Navigate your file system. Setup virtual environments. Install packages. Talk to Git.

## ACCESS IT VIA TERMINAL EMULATOR

For example: Terminal on Linux

## USES BASH SCRIPTING LANGUAGE


THE SHELL
INSTALL PYTHON
VENV
ANACONDA
UV

# DIFFERENT WAYS TO MANAGE PACKAGES

## PIP & VENV

Package management

Virtual environment management

Very mature

## ANACONDA

Package management

Virtual environment management

Focus on Data Science

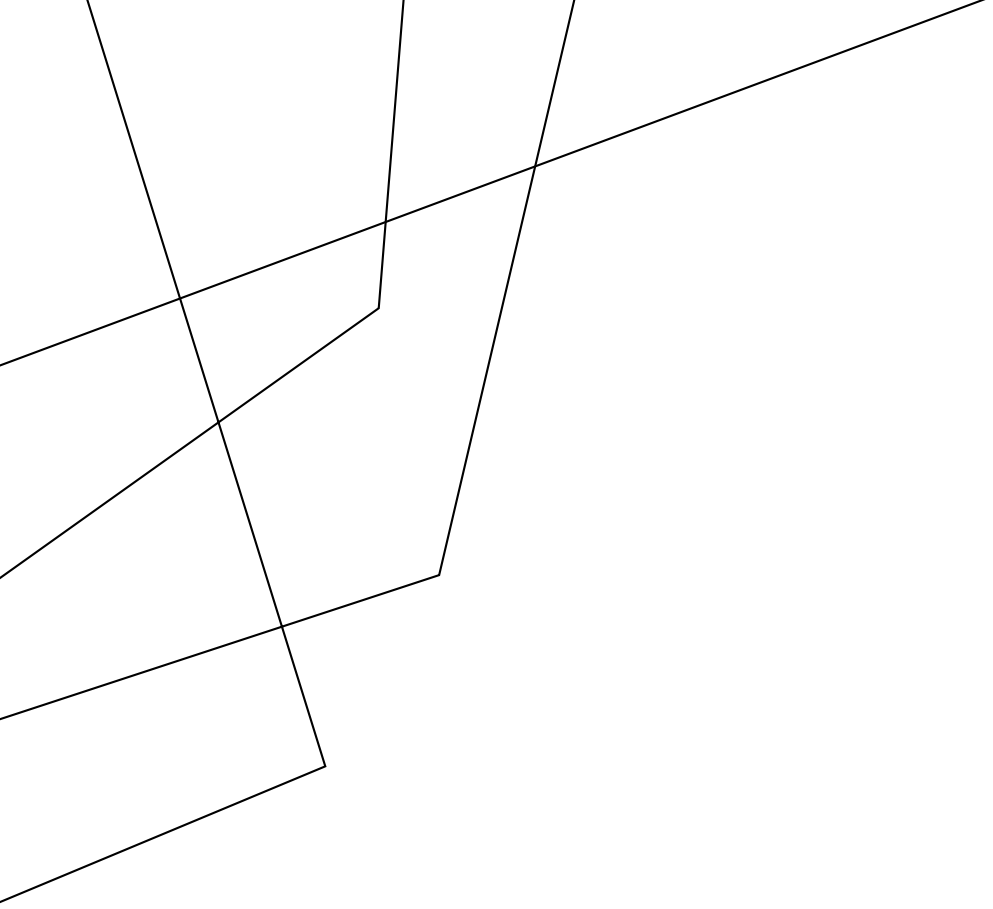
## UV

Package management

Virtual environment management

Fast

Ideal for general Python dev



# GIT

## Book of Git

Read everything about Git here.

## A version control protocol

Records changes to a file or set of files over time so that you can recall any previous version at any point in time.

## Branches for parallel development

People create **branches** to work on features in parallel and **merge** branches later.

## GitHub is a popular platform for using Git

Highly recommended for your own projects

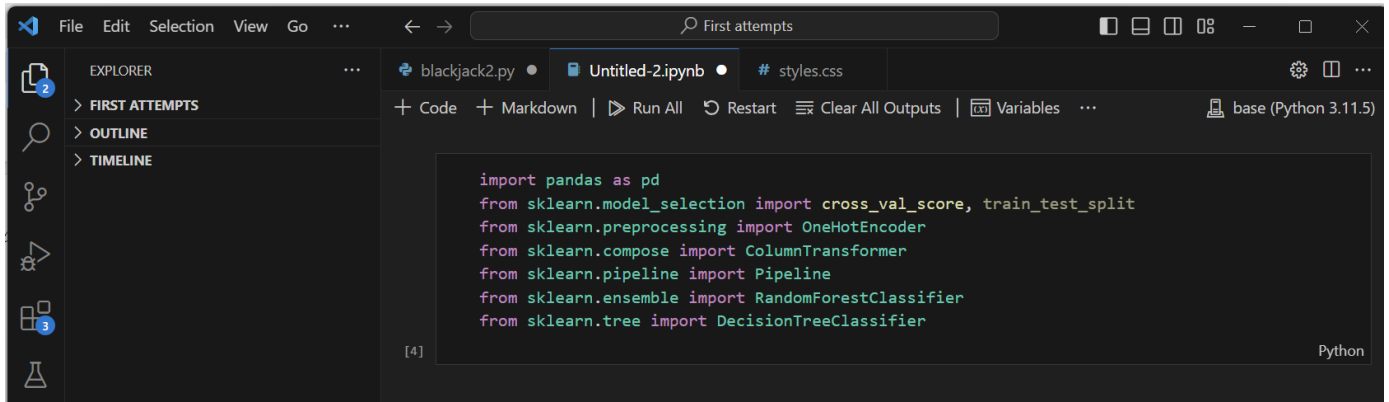
# DEVELOPMENT ENVIRONMENTS

## Integrated Development Environments (IDE)

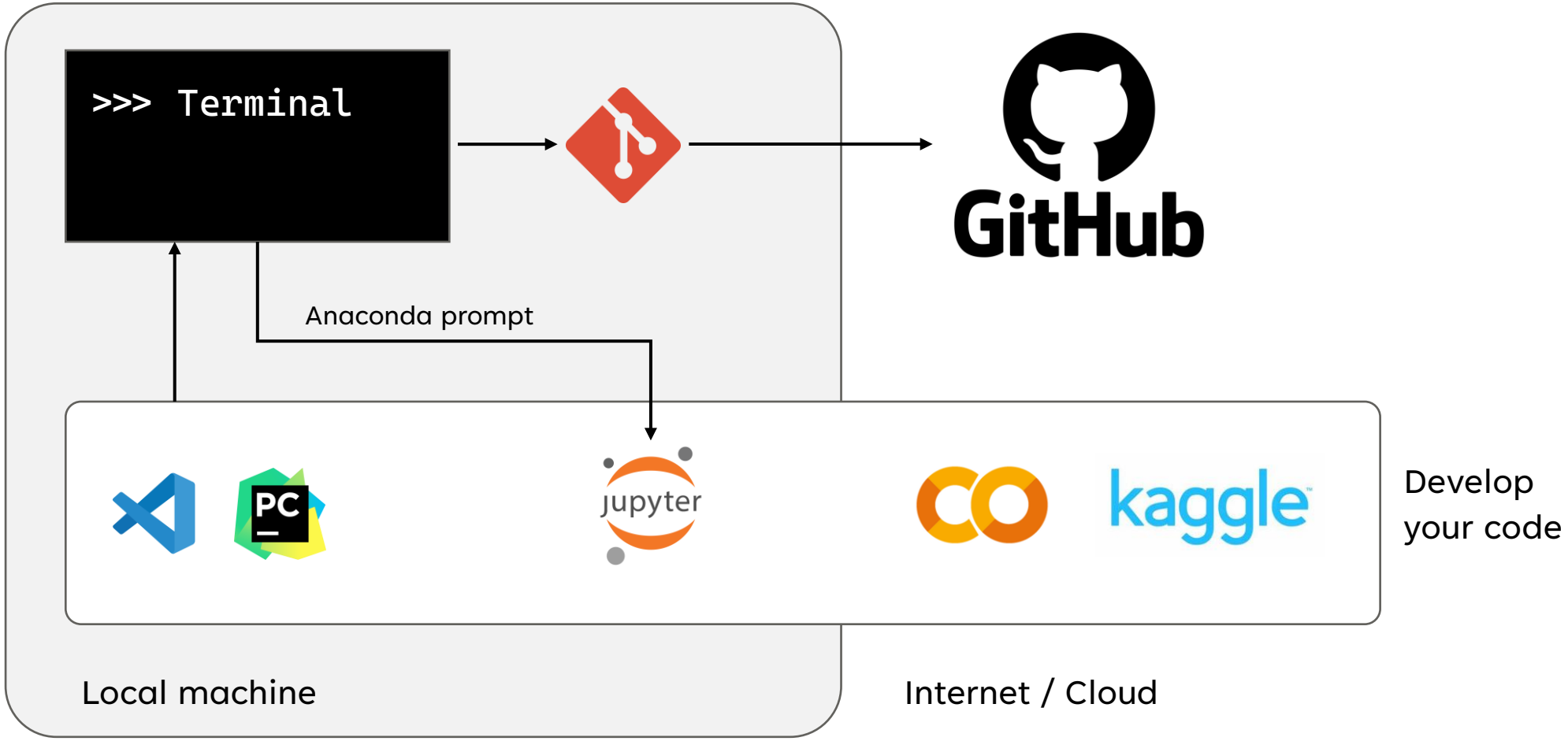
- Visual Studio Code
- PyCharm
- Spyder

## Notebook Environments

- Jupyter Lab / Jupyter Notebooks
- Kaggle
- Google Colab

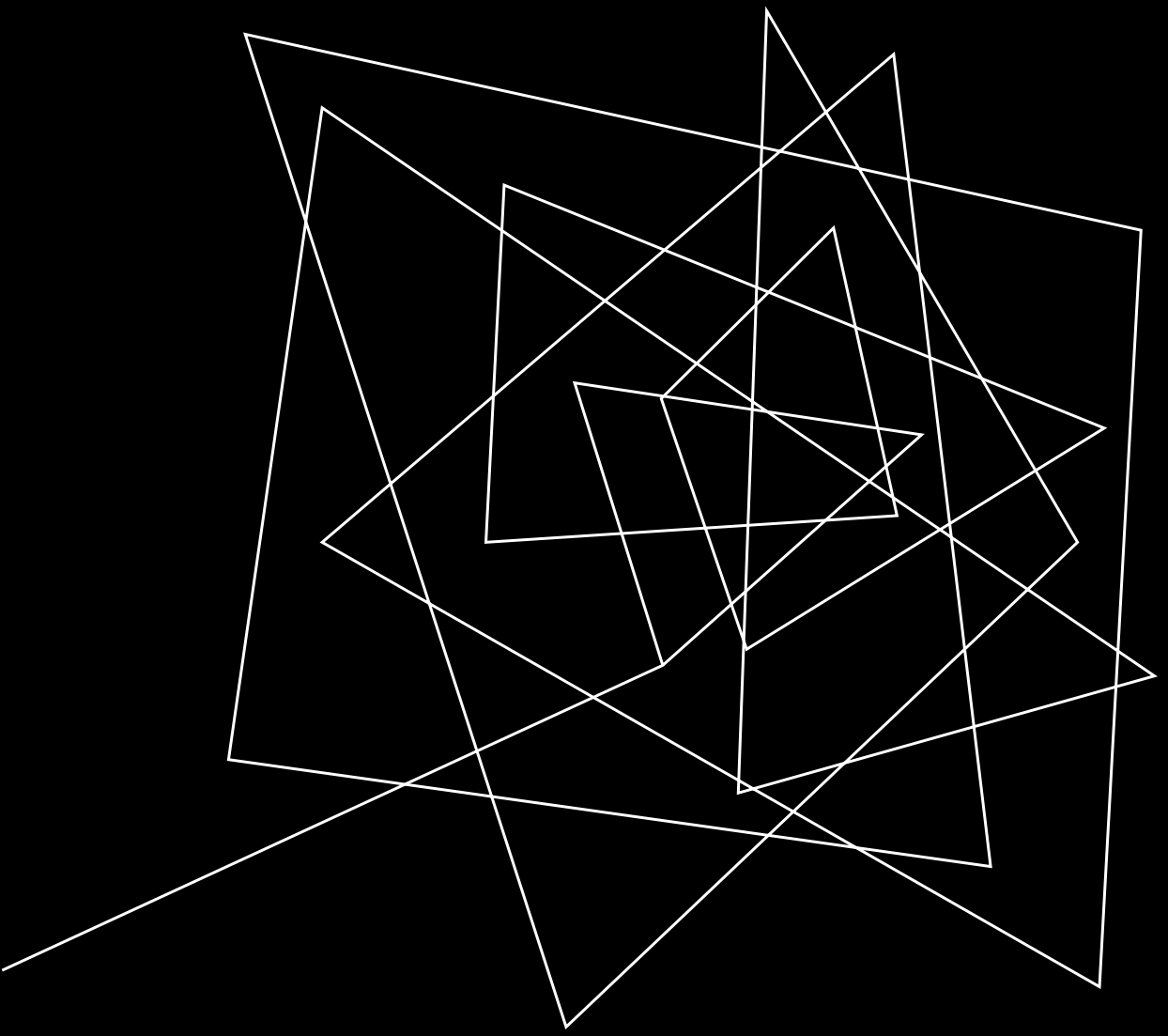


# A (SIMPLIFIED) EXAMPLE SETUP



# USEFUL

- Useful:
  - How to Set Up a Data Science Project
  - Terminal for Mac users – iTerms (features)
  - Terminal modification, if you'd like it to be more colourful
  - Bash vs. zsh
  - Difference between conda and pip
  - Git in a nutshell
  - Fundamentals of computing & programming



# LET’S SETUP AN EXAMPLE PROJECT TOGETHER

# MAKE SURE TO

## Have your software installed

Terminal, Anaconda, VS Code or PyCharm

## Have your accounts set up

Github

## Follow these instructions

Lucamiras/dsr-teaching-setup: Introductory material for new students at Data Science Retreat Berlin. (github.com)

## Stop me and ask

We’re all learning here

GIT CLONE

HTTPS://GITHUB.COM/LUCAMIRAS/DSR-TEACHING-SETUP.GIT

# MY APPROACH

## ONE .VENV PER LECTURE

Ideally use the requirements.txt file provided by the teachers

Avoid package incompatibilities

## LOCAL FOLDER / REPO PER LECTURE

Keep things organized

Make a separate folder for experiments

## TAKE PLENTY OF NOTES

Nothing against physical notebooks – Thinking with your hands

Use your favorite notetaking app

# MEETUPS

Data Science Retreat

Generative AI on AWS (San Francisco, Global)

GenAI Gurus - Generative Artificial Intelligence

Berlin DataTalks Club & their slack

Berlin Machine Learning Group

meetup.ai

Deep Learning Würzburg

PyData

Google Developer Group

Berlin Computer Vision Group

Advanced Machine Studying Group

PyLadies Berlin

Women Techmakers Berlin

# RESOURCES TO WATCH

StatQuest with Josh Starmer – YouTube

ritvikmath – YouTube

3Blue1Brown – YouTube

Kaggle – YouTube

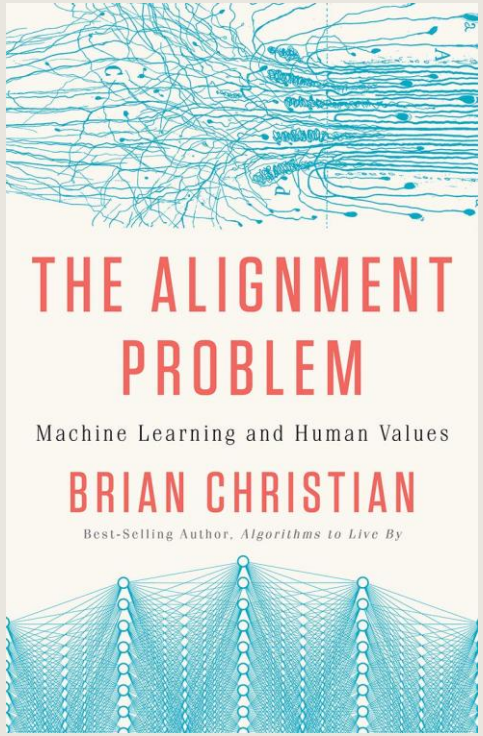
DataCamp -YouTube

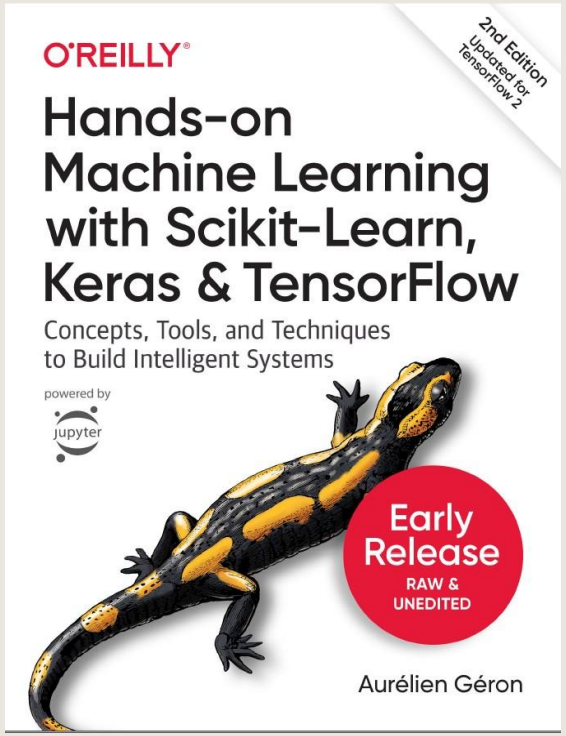
Two minute papers - YouTube

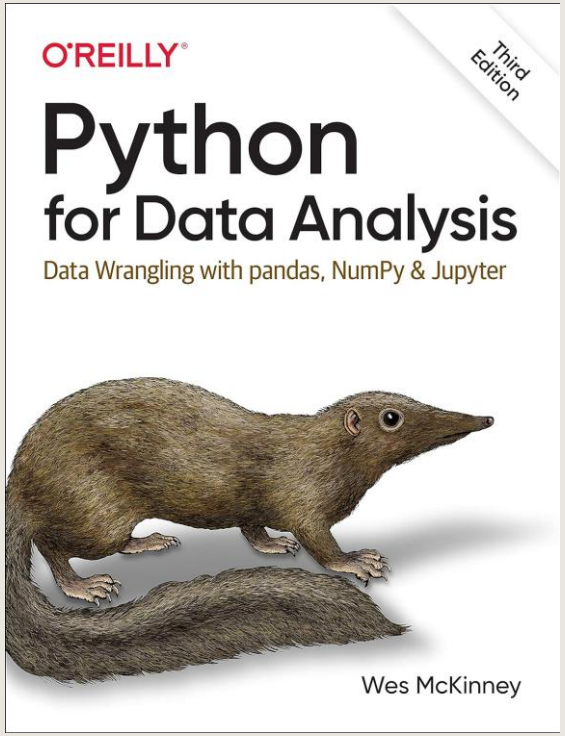
Machine Learning Mastery – YouTube

... and many more

# PERSONAL BOOK RECOMMENDATIONS



# UNSOLICITED ADVICE FROM A GRIZZLED ALUMNUS

- Learning is a privilege
- But time flies, and this will be over quick
- Pause for a moment every once in a while

# OBLIGATORY EXPECTATION MANAGEMENT

The next three-and-a-half months will be challenging, demanding, exciting, eye-opening and, hopefully, fun.

Time is short, so work hard, but give yourself time to rest. Nobody gains anything if you burn out.

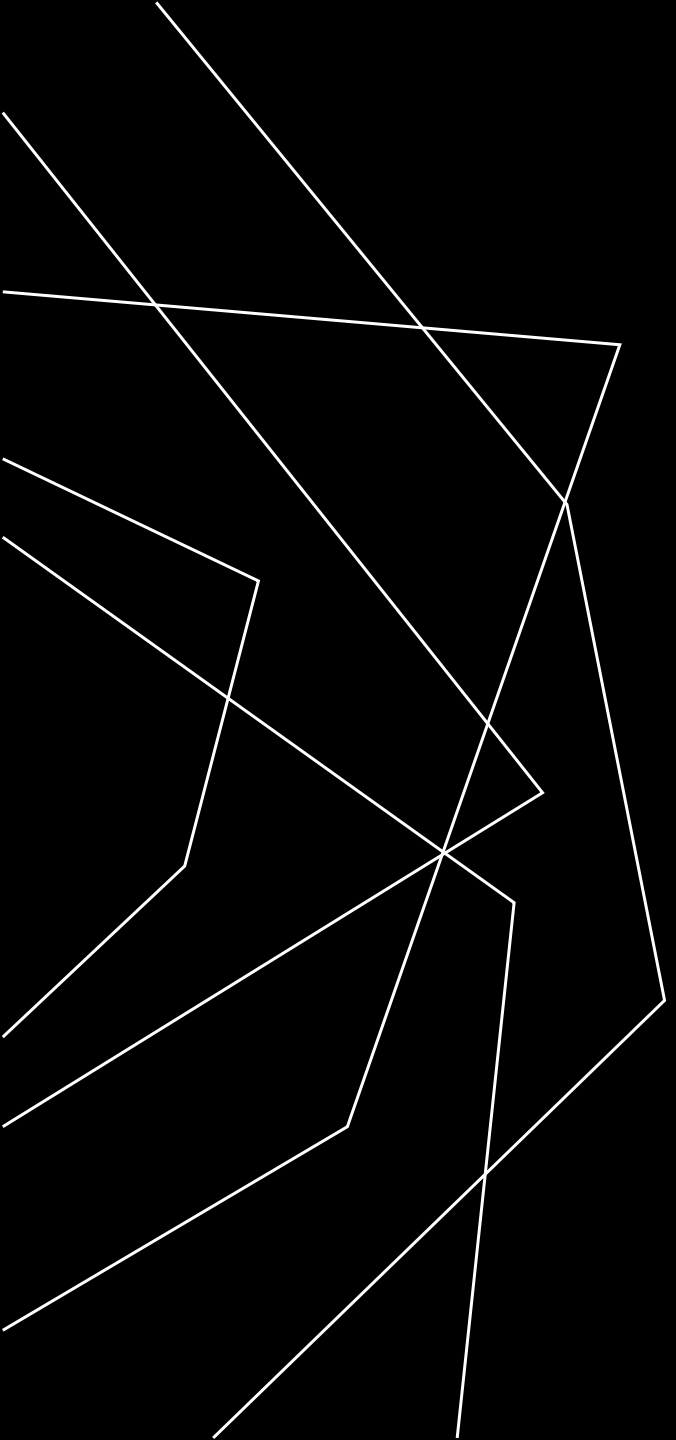
It’s a marathon, not a sprint – but even after a marathon you celebrate and don’t run the next one next morning.

Don’t be afraid to speak up. If something doesn’t work for you, it’s important for the team to know.

Believe in yourself.

Enjoy yourself.

You can do this!



# THANK YOU

Any questions?