Context Is All You Need: AI Engineering with the Petoi 'Bittle X' Robot Dog

Overview

In this workshop, students will learn the fundamental concepts of AI Engineering by connecting Large Language Models (LLMs) to the documentation for programmatically controlling the Petoi 'Bittle X' Robot Dog. This hands-on experience demonstrates how AI becomes truly powerful when given the right context, transforming from a general-purpose tool into a specialized assistant capable of controlling hardware through natural language.

Key Objectives

By the end of this workshop, students will:

1. **Understand AI Engineering**: Learn what distinguishes AI Engineering from traditional programming and why it's becoming the future of software development.
2. **Experience Context Engineering**: Discover how giving AI specific context (like API documentation) dramatically improves its capabilities, making it more useful than general-purpose AI.
3. **Build an AI Context Pipeline**: Connect the Petoi API documentation to an AI model, enabling natural language control of the robot.
4. **Practice Responsible AI**: Implement transparency features that show exactly what commands the AI sends to the robot before execution.
5. **Develop Problem-Solving Skills**: Use AI tools like GitHub Copilot, Microsoft Copilot, and ChatGPT to overcome coding challenges, regardless of prior programming experience.

Materials

- Petoi Bittle X Robot Dog (1 per 5-6 students)
- Laptops with Python and VS Code installed.
- The Python files required to control the Petoi Bittle at https://github.com/PetoiCamp/Petoi_MindPlusLib/tree/main/python/libraries but packaged into one easy to use file called `Petoi.py` in this folder
- The Python packages: `openai`, `python-dotenv`, `pyserial` installed via `pip`.
- An OpenAI API key in a `.env` file. Get one at https://platform.openai.com/api-keys and create a `.env` file in the same directory as the project's code file.
- The Petoi Python API specification created for this workshop found in this folder. The official Python API spec can be found here

Rough Draft

DELETE EERYTHINV BELOW WHEN DONE.

(Short intro here)

(Following bullet points are rough outline of where I'm going with this workshop. Maybe needs to be an Overivew section then another section called Key Objectives than another section called Mateirals then another section where we do the 1,2,3 exact steps to execute the workshop including all required code in a sub folder called "code" of this same folder that we link to if it's a lot of code, or if not just inline as code fenced)

(Find some place in this to link to https://www.philschmid.de/context-engineering where it talks about how th enew skill in AI isn't really just prompt engineering it's context engineering where you hav eto put in work to give AI the right context. You as a human connect the dots)

- Teach students the fundmeantal concept of AI Engineering, the importanc eof connecting AI, speciifacally in this calse large languge models (LLM's), with specific stores of contextual knowledge to empower them to actually provide value. THis is part of the growing field of AI Engineering, as anointed by Andrej Karpathy, (speak here about who he is, his prestige, role at OpenAI, and contirbutions to the space).
- We assume that the students have played around with ChatGPT. They've used it. AI is in their face, it's everywehre. They've likely had expeirences where it kind of sucked. Why? Well, the model was trained on a set of data, and that' sall it knows. It isn't alive. It isn't constantly retraining itself. The training process itself is veyr expesninve and take stime and massive compute.
- To combat this, in 2020 Meta relaased to the world a strategy called Retrieval Augmented Generation where they basically gave the ability for an AI model to go and look up more informaion live from data sources that someone wires up to the model. Now it can know things beyond all of what it was trained on, which is good, but how much important data is there out there that isn't pubicly available for OpenAI or Google or Meta to train thierm odels on or simply the fact that there's just too much out there to train a given model on literally it all ,so you got to have people using these models go and put in some work to connect the model to their rich source of information that can make it a lot more useful for them. Use analogies that are reltable to Gen Z high school studnets to drive this home.
- Emphasize what a model is. use the analogy "hey when you se ChatGPT do you ever see that drpdown menu? Why are their different options"? and the point of defining this is to get to them mentally "oh wait they trained each of these things on data, on informaiton, and twewaked them to be good at diffrent things, but if I want to use one for my own thing, let's say have it help me write, and all my writing is in my private Google Drive, well then I'd have to do some work connecitng a model to my data so it can really help me". The yhave tools these days to help you do that and those tools are built by software engineers, product managers, busienss anlaysits, data scentists, data nalaystis, all of htese people are hopping on the boat and becoming AI Engineers, people connecting Ai with rich complciated sources of knowledge.
- Okay, now we have set the stage, now we have explained where were going, now we're going to put this live into action using a fun tool, the Petioi 'Bittle X' Robot Dog.
- The robot dog has a manual. The company that makes it, Petoi, has done all the hard work of doing the math and putting hte robot dog togehter and all that real challening stuff of figuring out the low level code that's required to control it. on top of that, using a high level proramming language, they've given us the baility to control the robot dog with PYton or C++. (Try to help the studnets understand low level verseus high level very simply. Layers of abstriaciton)

- But here we have an opporuntity! We could write code in Python or C to do all sorts of fun things with the robot dog, have it do dance routines, and backflips, even write a program to have it be a guard dog and all that. That's traditoanl software development/engineering, that's what programmers do, but these days with AI, we have anotehr path. With those same coding skills, instead of writing all the code yourself to make the robot dog do sometihg, yo ucan assume the role of an AI Engineer!
- Since we have really good documetnation about what kind of code you have to write to make the robot dog do something (We have an APi, applicatio nprogram interface, provided by petoi, beasically a set of really detailed instructions. a manual, a guidebook, for anyone writing code to intearct wtih their rpoduct, companies do this all the time for things they give to the world. For example, TikTok and Instagram have API's that let programmers write their own code to control stuff. Ever seen bot accounts on TikTok or IG? That's how people build them, they write code agnaist the TikTok or IG API!). Since we have a robot dog API, we can connect it to an AI model and then write natural language (prompts, prompt engineering!) to control the robot dog. That's being an AI Engineer!
- So, what we're going to do is challenge you to write the kidn of code that allows AI to know how to control the robot dog without you having to write it all yourself in terms of writing a routine
- (At this point I need to have a specific goal for what they should accomplish after connecting the AI model to the petoi documeatntion/instructions. Like if they get it connected what should they type into the chat window to try and get the robot dog to do some sort of specific routine and then I come around and validate they did things correctly, or have challenge sof what should be posssible basedo n how they wrote their code)
- Students should be writing Python code, and using AI (they can use Microsfot Copilot, ChatGPT, whatever) to help them connect the dots.
- The challenge here is that this workshop needs to be approchable to studnets of all bakcgrounds. Python is known for being syntatically simialar. The code they're editing should give them enough hints and clearity about where to start and what to change to get things working. Even if a student has zero coding background, a part of this workshop is opening hteir eyes to the world we live in with AI. Don't tell me you havae no idea how to code, tell me you know how to go to ChatGPT or Copilot, copy and paste in all the code, ask it to explain to you what it's doing becuase you don't know jack squat about coidng, even give it the petoi specs and the challenge, and have it tell yo uexactly what to do to figure this out. That's what I want to see. I want to see problem solving studnets. I want to see hteir minds open to the world we live in. Don't sit there and say you can't do it, use every tool available to you to solve hte problem.
- So the goal is for them to succesfully build a sort of RAG pipeline that connects the specification for the petio bittle to a model and then the chatbot (this part we got to figure out, the chatbot piece, maybe just the terminal? Make it simple, have then run the python code and it tunrs into a live terminal that's their chatbot) where they should be able to just chat and control the robot dog that way. They should have semeantic level menaing, just kind of describing things and having the chatbot use AI and send commands to the robot dog.
- One key piece of the code they write is the challenge that every single command the chatbot sends ot the robot dog it should return to you in a nicely formatted strucutred list like "I sent the following code commands to the robot dog". Drive home Repsonsibe AI heare. Don't let this thing do whatever itw ants, that's like a black mirror episode.

Logisitscs

Logistiscs on how to pull off this workshop.

- Studnets are working in browser based https://vscode.dev/ so that we don't have to install VSCode on every laptop.
- Challenge is checking if from VSCOde deve you can connect to the petoit that's linked via bluetooth or manually plugged in. Or do you have to install all sorts of local stuff ot enable coding iwth the petoi bittle

Challenge Station Idea

Could I have a condensed verison of thi sworkshop where I don't think of it as a whole thing delviered to sutdents but I have a 1 page print out that's set next to a laptop all set up with the loca lstuff required to be connected to the petoi bittle nad the 1 page print out is a challneg sheet like "Cna oy usolv ethis challenge!" or "Can you be an AI Engineer?" or something like that and it has python code in VS Code and it very succintly says stuff like

- The progrma you're looking at is called Visual Studio code! (briefly explain what it is)
- The robot is the Petoi 'Bittle X' robot dog!
- In VSCode, there' sa file called (name of the file with all the speciifc API call instrucitosn for the petoit)
- Also in VS cod,e there's this window to the right hta has a tool caleld GitHUb Copilot (or maybe I do this using a terminal or a prebuilt cahtbot web interface I don't know)
- They are encouraged ot use GitHub Copilot inside of VS Code to solv ethis. Specifiaclly we want them to learn ho wto use that ssince it's a coding based AI tool. Explain it as it' slike CHtGPT but specifially for coding, it can see all the file soy ucan, ask it some questions! Sort of thing
- Can you figure out how to change the code in (python cod efile name here) such that the AI chatbots model is able ot undrestand how to control the robot odog and you can write natural langauge commands to make the dog do things?
- This is called AI Engineering? Do you have what it takes to be an AI Engineer?

So this way instead of having to scale the robot dog to a classroom that might have 40 students and given the $300 price tag of the dogs it's going to be hard having 5+ students huddled around 1 laptop trying to do this 1 thing at the same time, it becomes a challenge sort of thing. Maybe there's a main workshop where there's other AI related teaching going on and studnets are released in small groups, or 1 by 1 to see if they can solve the challenge, and always have some easy way to reset the challenge (maybe a reset button or script that just uses git to reset to the local verison, revert all changes, use verison control)

I like this idea. Then any studnet that solves the challnege has to call an insructor over for validaiton and we give them an AI Eningeer ceriticate and maybe some candy and have them take a pictaure with the robot dog and the laptop and praise them for problem solving. The challenge can be on tables during lunch or an ope nnetowrking session or something like that.

(The Challenges need to be each a 1 page document separate from this overall Context is all you need AI Engineering workshop, but this document can link to them)

Here are the challenges in short I wnat.

1. The challenge mentioned baove, can you be an AI Enigneri wth the robot dog.
2. A varaiton of the same challenge that uses the Robot Dog with the Robot Arm and specifically is aksing stusetns to write code ot have the robot dog pick up and move an item (keep references to the item generic, examples would be a tennis ball, smal cup, etc.)

Both could be in the same 1 page document that you just clearly say someting like "if you're working with the robot arm dog then this is your challenge else if you're working iwth the standard dog" sort of thing.