Algorithm Generation and FunSearch | Tutorial
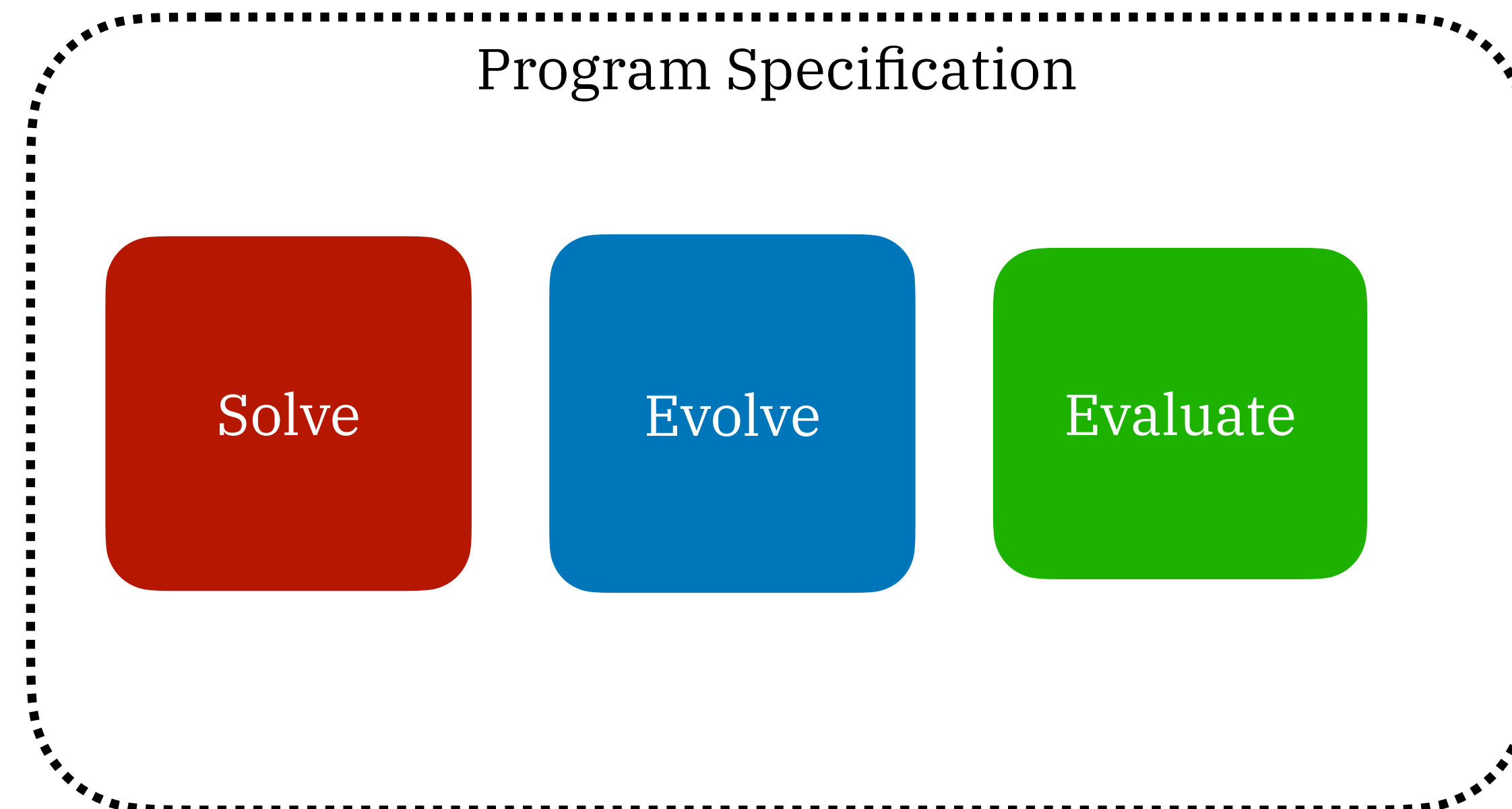
SLMath Summer School Tutorial

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Aim for tutorial and working group

To get funsearch running on a problem you find interesting!

Some sample questions

1. Find the largest subset of {1,…,n} such that no three terms are in arithmetic progression.

2. Find the largest subset A of {1,…,n} so that if $a, b \in A$ then $a + b \notin A$.

3. Given n vertices, construct a graph with the maximal number of edges without any triangles.

4. Build your own problem and we can figure out how to design it.

Program Specification

Solve

Evolve

Evaluate

Installation

We will be using the repository: https://github.com/kitft/funsearch. Follow the instruction installations there. We have given a summary here. You will need Python 3.10+.

Github
You can cd into a convenient directory and run the command: ```git clone https://github.com/kitft/funsearch.git```. You can alternatively download the zip file from GitHub.

Docker
Download the Docker Desktop app at: https://www.docker.com/products/docker-desktop/ Once you are done, open it and follow the instructions. Once you install and register, start docker desktop. You can verify the installation is complete by running ```docker —version``` in command line / terminal.

OpenRouter
You should sign up and make an account with https://openrouter.ai/ .Once you do that, hover over your profile icon and go to Keys. Then, generate an API key for yourself and copy it. On terminal / command line, cd into the funsearch repository. Then run a) Linux: ```nano .env```, b) Windows: ```notepad.env```, c) MacOS ```open .env```. Paste your API key as: ```OPENROUTER_API_KEY=<your_key_here>```. Then restart terminal / command line.

Optional but recommended: WeightsAndBiases
Make a account at https://wandb.ai/home. This is for visualizing your training states. Once you follow the steps and make an account, you can go to your profile icon and select API Key just as with OpenRouter. When you copy the key, then on terminal / command line, cd into the funsearch repository. Then run a) Linux: ```nano .env```, b) Windows: ```notepad.env```, c) MacOS ```open .env```. Paste your API key as: ```WANDB_API_KEY=<your_key_here>```. Then restart terminal / command line.

Running FunSearch

cd into your funsearch directory. First, we will build the necessary directories and docker containers. Run:

1. ```mkdir data```
2. ```docker build . -t funsearch```

Then run:

3a) MacOS / Linux: ```docker run -it -v ./data:/workspace/data -v ./examples:/workspace/examples --env-file .env funsearch```
3b) Windows: ```docker run -it -v "${PWD}/data:/workspace/data" -v "${PWD}/examples:/workspace/examples" --env-file .env funsearch```

You should see something like ```root@7727c0f7dce1:/workspace#```. Then you should be able to run:

```funsearch runasync /workspace/examples/cap_set_spec.py 8 --sandbox ExternalProcessSandbox --model mistralai/devstral-small-2505:free --samplers 4 --islands 4 --duration 120 —team <Insert your Weights_And_Biases_team> --tag <Enter any tag you want to use to find logs of this run on WAndB>```

After a few seconds you should see a weights and biases link which tells you that it's running! Open the link to see details of your run in real time! You're all set!