

Introducing Reference Data Types and Dynamic Object Allocation

Using visual debuggers to avoid common object misconceptions

Common object misconceptions

Review: Java Data Types

- Primitive data types are predefined in Java.
- Reference data types can be defined by the programmer.

Java Data Types		
Primitive Data Types	byte, short, int, long, float, double, boolean, char	Variable stores a primitive value
Reference Data Types	String, ArrayList, Scanner, ...	Variable stores an object reference

Reference Data Types

Java has several types of **reference data types**.

Review: What is an object?

TODO: real world objects vs software objects.

<https://docs.oracle.com/javase/tutorial/java/concepts/object.html>

All objects have **state** and **behavior**.

- State encapsulates the relevant properties (data) about an object.
- Behavior is the set of operations that access and modify the object state.

Object	State	Behavior
Dog	name breed	eat treat fetch toy

What is a class?

Template for describing similar objects.

define state (fields) and behavior (methods).

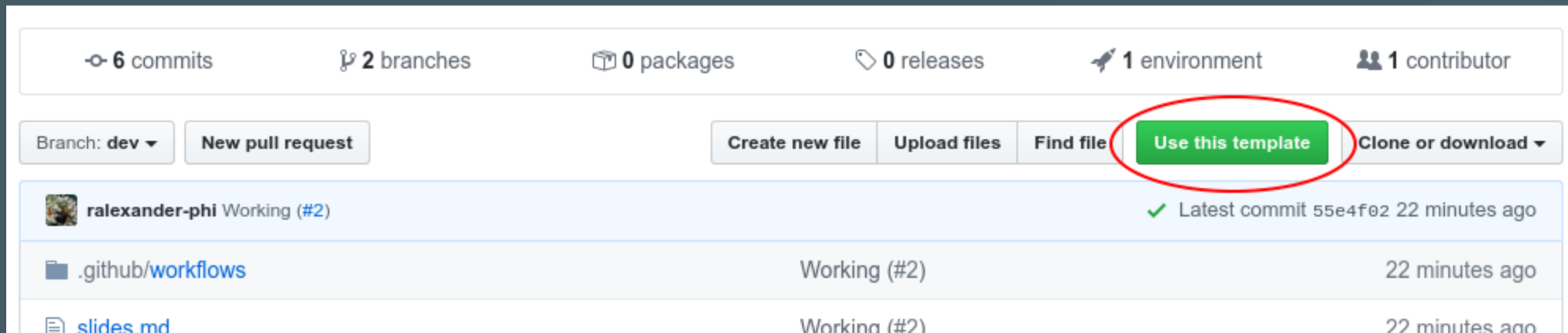
Dog Visualization

```
<iframe width="800" height="500" frameborder="0"  
src="https://pythontutor.com/iframe-  
embed.html#code=public%20class%20Fish%20%7B%0A%0A%20%2  
0%20%20//Field%20declarations%0A%20%20%20%20String%20spe  
cies%3B%0A%20%20%20%20int%20age%3B%0A%0A%20%20%20%20  
%20public%20static%20void%20main%28String%5B%5D%20args%  
29%20%7B%0A%0A%20%20%20%20%20%20%20%20%20//%20Declar  
e,%20instantiate,%20and%20initialize%202%20Fish%20objects%0A  
%20%20%20%20%20%20%20%20%20//%20Each%20variable%20stores  
%20an%20object%20reference%0A%20%20%20%20%20%20%20%20%20%  
20Fish%20bubbles%20%3D%20new%20Fish%28%29%3B%0A%20%  
20%20%20%20%20%20%20%20%20Fish%20jaws%20%3D%20new%20Fish
```

Setup

Want to create your own?

First, create a new repo
[from the template repo.](#)



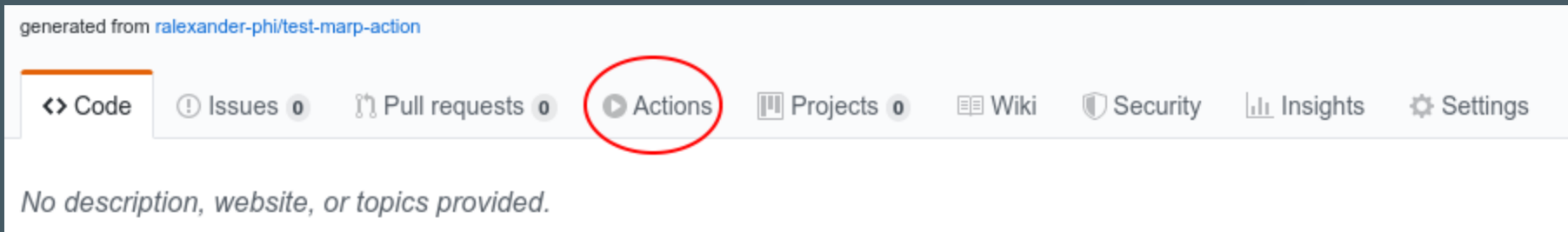
Configure GitHub Pages

Open your new repo and [setup publishing](#).

You'll typically use `gh-pages` as the deploy branch.

Review Build

Click on Actions tab and see if the build succeeded (it may take some time).



You should now see the generated files in the `gh-pages` branch.

View webpage

Open your deployed webpage to see the content.

Out of the box you should see `README.md` as `/index.html` and `/README.pdf`.

Slides under `docs/` are also converted.

Running locally

Locally you'll run commands like:

```
$ marp README.md -o build/README.pdf
```

or

```
$ npx @marp-team/marp-cli@latest README.md -o build/README.pdf
```

As a workflow step

The workflow runs an equivalent step:

```
- name: Marp Build (README.pdf)
  uses: docker://marpteam/marp-cli:v1.7.0
  with:
    args: README.md -o build/README.pdf
  env:
    MARP_USER: root:root
```

Note the `args` match the previous slide.

Customizing the build

Anything in the `build/` folder will be deployed to GitHub Pages.

You can copy extra files or run further processing steps using other tools.

Learn more about Marp

This is a good time to learn more about Marp. Here's some resources:

- [CommonMark](#)
- [Cheat Sheet](#)
- [Themes](#)
- [CSS Themes](#)
- [Directives](#)
- [VS Code plugin](#)

Example Sites

Known sites using this action are:

- [University of Illinois at Urbana-Champaign's CS 199 Even More Practice](#)
[\(code\)](#)
- [Exploring agent based models](#)
[\(code\)](#)

Send a [pull request](#) to get your site added.

Publish your slides

When you are ready to share your presentation, commit or merge to `main` and your content on GitHub Pages will automatically update.



Hooray!