UNIVERSITA' DEGLI STUDI DI
NAPOLI FEDERICO II
Scuola Politecnica e delle Scienze di Base
Corso di Laurea Magistrale in Ingegneria Informatica

TESI DI LAUREA MAGISTRALE IN INGEGNERIA DEL SOFTWARE 2

Analysis of usage of Continuous Integration practices in open-source projects

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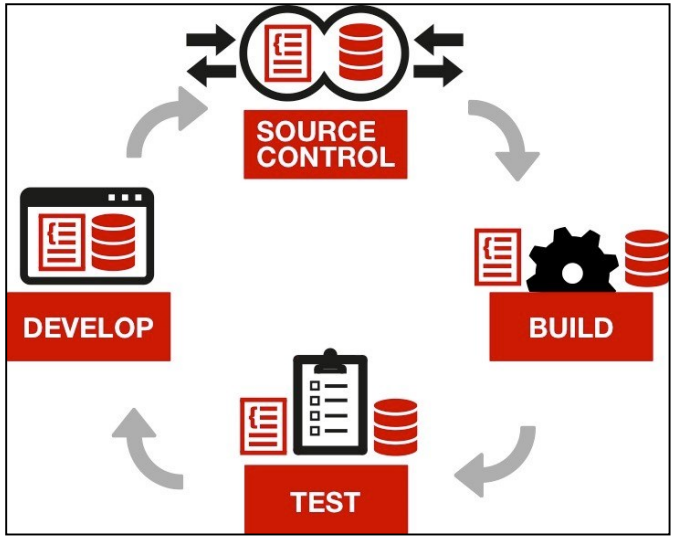
Continuous integration

- Continuous Integration(CI) is a set of **software development practices** that allow software development teams to generate software builds more quickly and periodically, which allows the **earlier identification of errors**.
- CI has been claimed to introduce **several benefits** in software development, including high software quality and reliability
- However, recent research pointed out challenges, barriers, and **bad practices** characterizing its adoption.



GitHub actions

- **GitHub actions** help you automate your software development workflows in the same place you store code
- You can configure your **CI workflow** to run when a GitHub event occurs.
- Workflows must be configured using **YAML syntax**

```yaml
name: CI

# Controls when the action will run. Triggers the wo
# events but only for the master branch
on:
  push:
    branches: [ master ]
  pull_request:
    branches: [ master ]

# A workflow run is made up of one or more jobs that
jobs:
  # This workflow contains a single job called "buil
  build:
    # The type of runner that the job will run on
    runs-on: ubuntu-latest

    # Steps represent a sequence of tasks that will
    steps:
      # Checks-out your repository under $GITHUB_WOR
      - uses: actions/checkout@v2
```

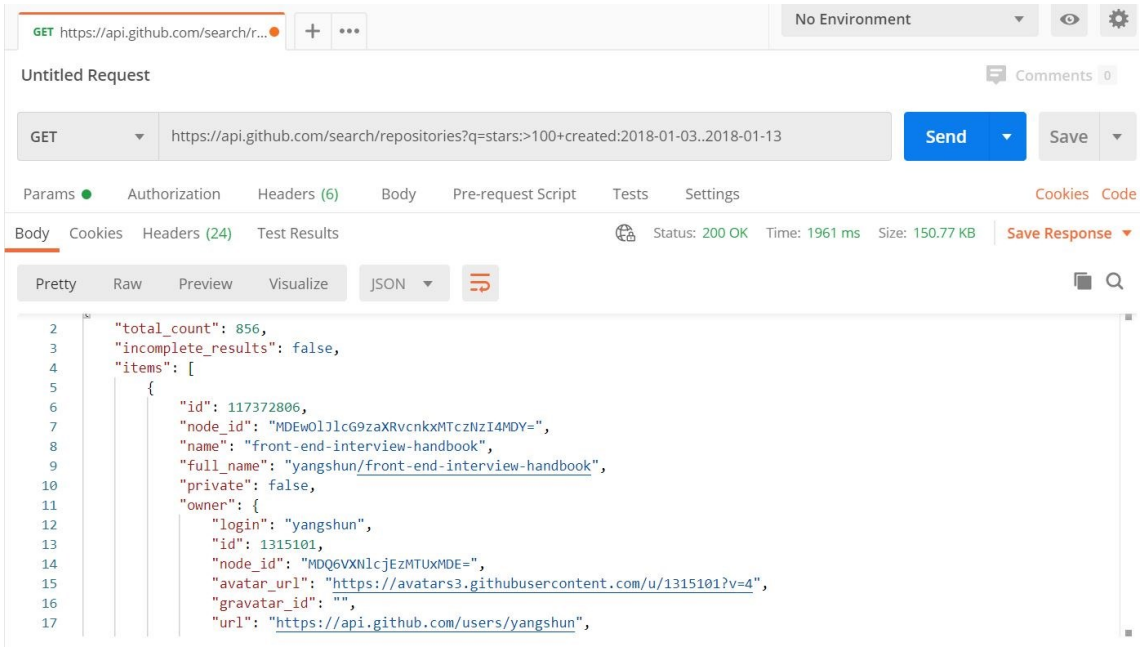
Goals

- To analyze usage of **Continuous integration** in open-source projects
- To study CI **Github actions** tool's general usage
- To perform an analysis of **bad practices** encountered when adopting Github actions CI tool

Experimental procedure(1)

- We used **GitHub Rest API V3** to analyze repositories created **from 2018 on**, with **more than 100 stars**,
- We studied **43193** repositories overall.

Rest API V3



Experimental procedure(2)

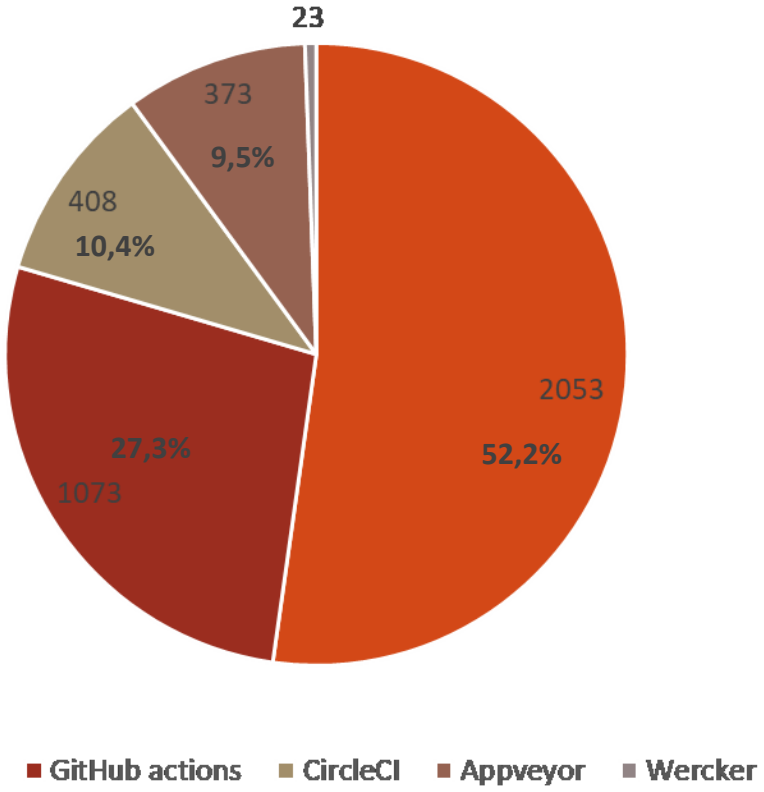
- We further analyzed projects that use **GitHub actions** tool
- We studied **1768 YAML files** using GitHub actions as a CI tool
- We used **node.js** technology, and **YAML** library, installed by using NPM, a package manager for Node.js packages

Analysis of usage of Continuous Integration practices in open-source projects

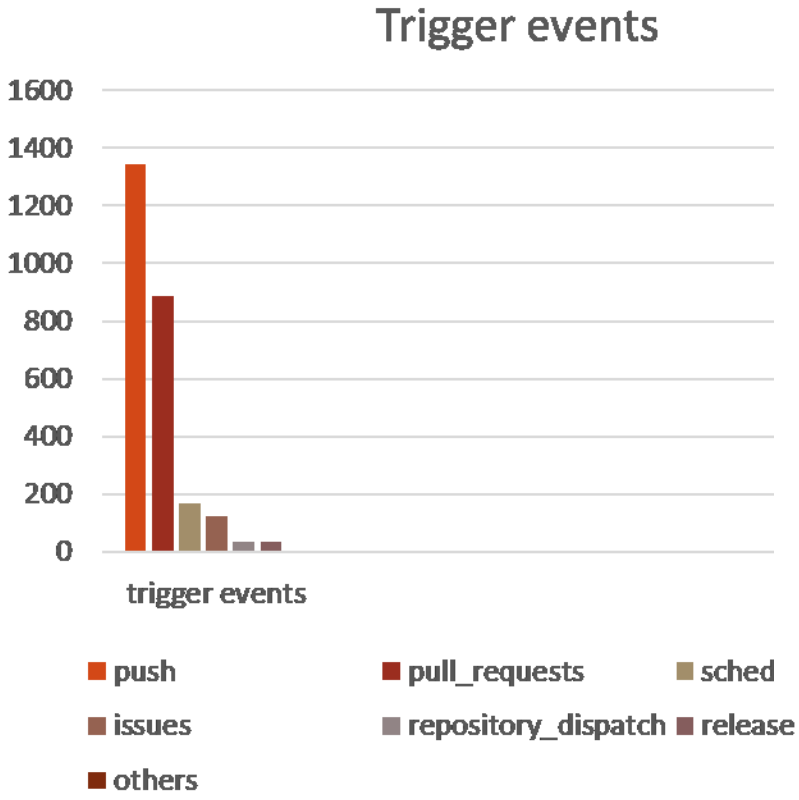
Research questio

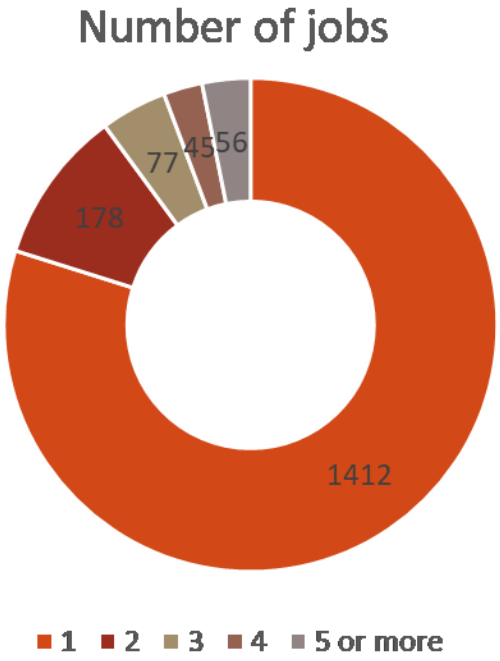
- **RQ**: What is the brea
usage of different CI
open-source projects

- **Result**: Travis is so fa
the most used CI too
open-source projects
followed by GitHub
actions tool



Research questions: General GitHub actions usage(1)

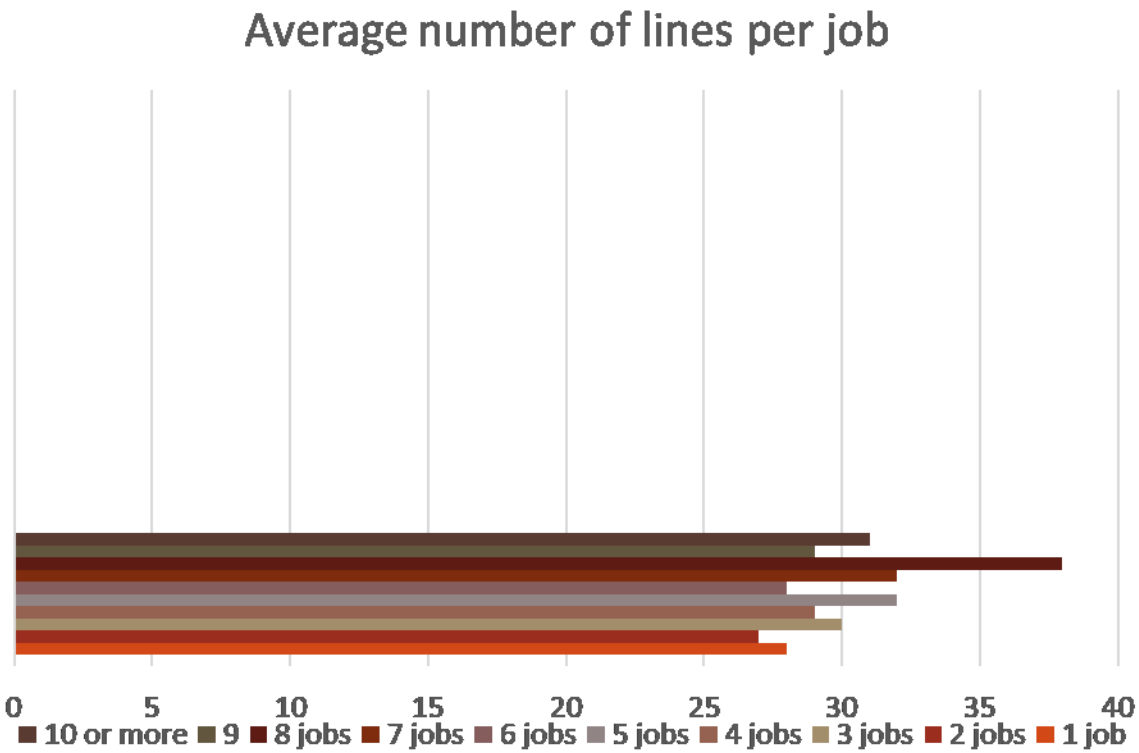


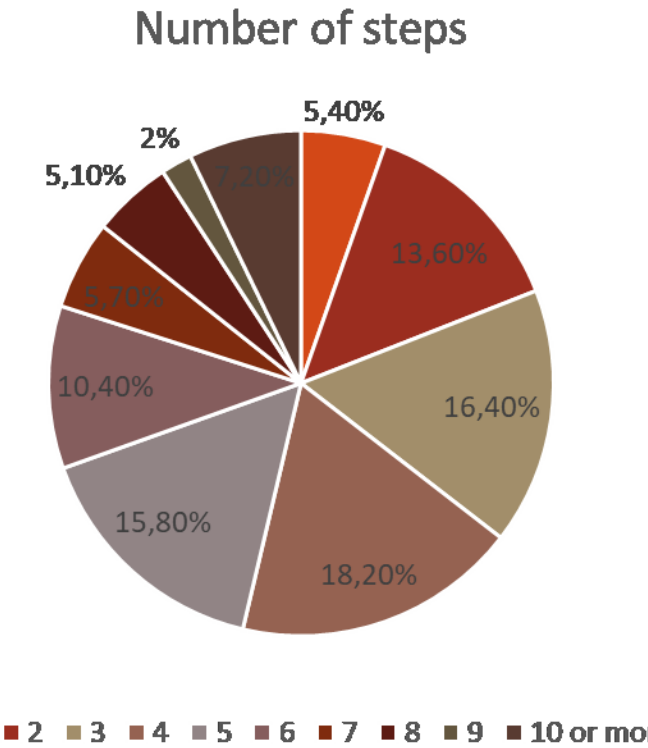


are CI GitHub actions files?

Research questions: General GitHub actions usage(2)

- **RQ**: How much complex are CI GitHub acti





Research questions: Bad practices (1)

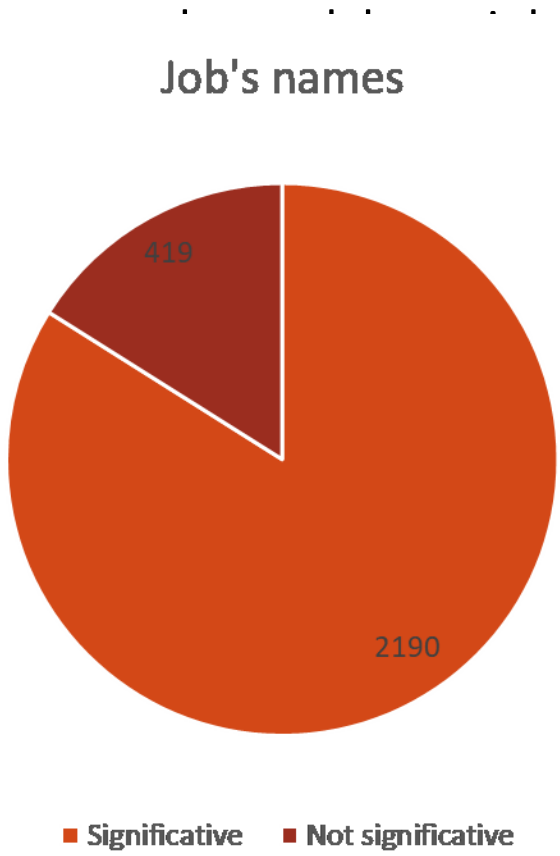
- **RQ**: How frequently are jo
automate?

- **Procedure**:

- We **classified** jobs in class
test, **deploy**, **release**, etc,
words that their names/id

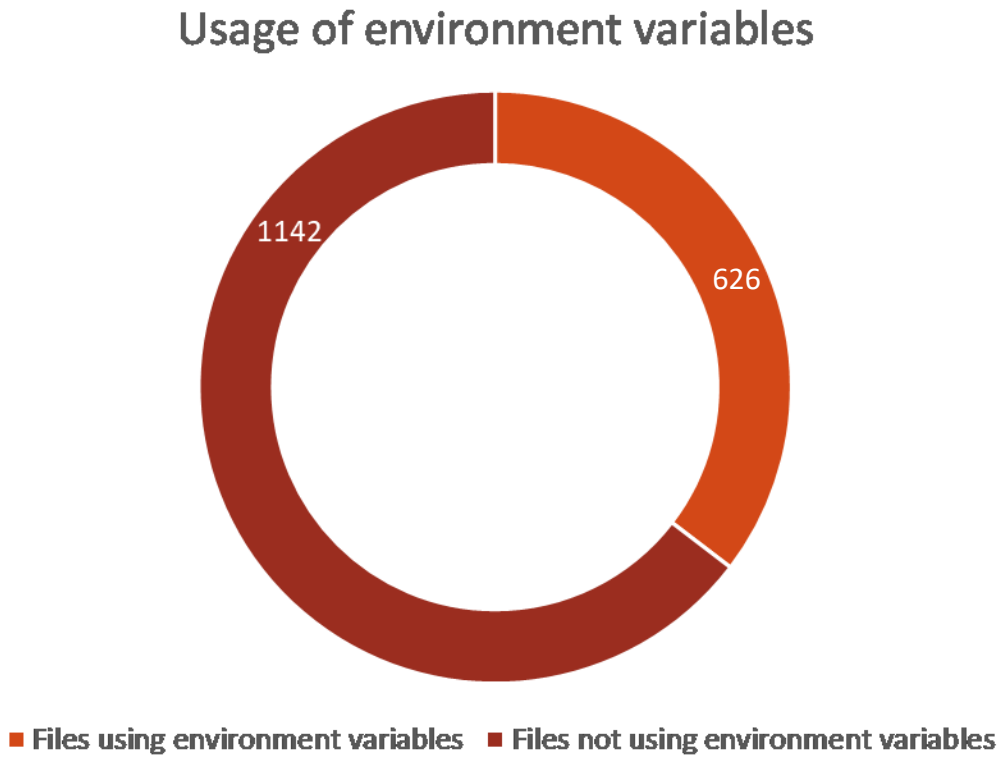
- Jobs not belonging to any
considered meaningless

- Not every job's name belo
class is considered meanir
generic, hello world)



Research questions: Bad practices (2)

- **RQ**: What is the usage of environment variables/absolute paths/comments in GitHub actions?

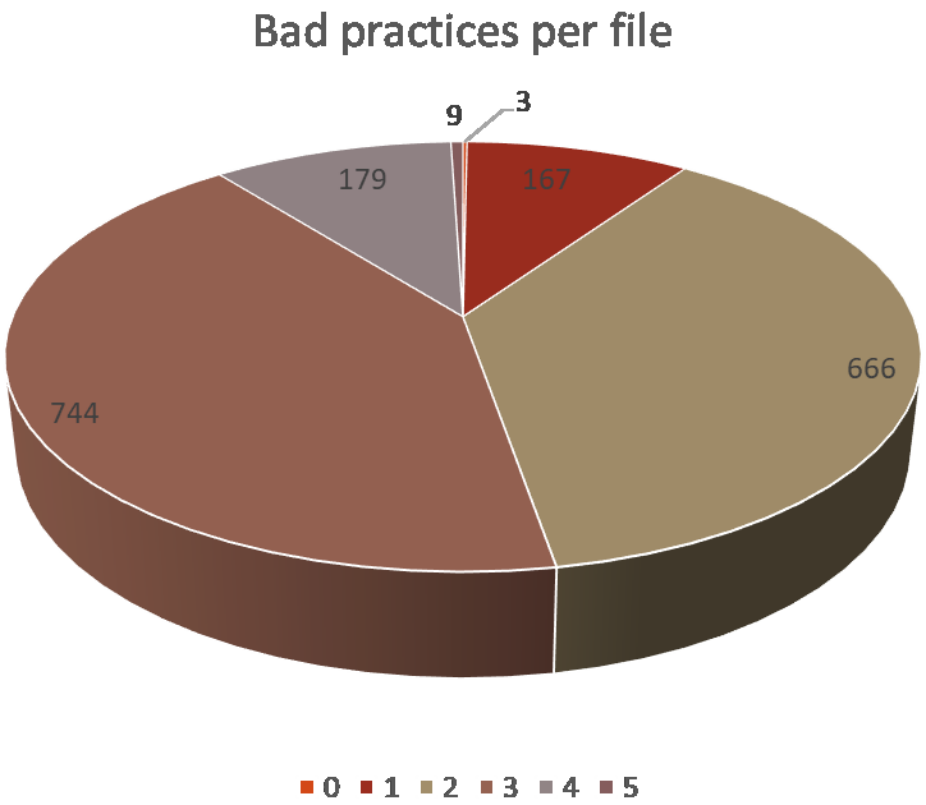


olute	% files	# files
	9,9%	175
	90,1%	1593

nts?	% files	# files
	31%	548
	69%	1220

Research questions: Bad practices (3)

- **RQ**: Hc
simulta



Conclusions

- **Travis** is so far the most used CI tool, but the **Github actions** usage is also widespread in open-source projects

- **GitHub actions** are used mostly to automate **build** process, and prefer **monolitic** builds.

- **Bad practices** such as absence of comments or non-use of environment variables are really widespread when adopting GitHub actions, whilst absolute paths are not really used.

Future directions

- To **search** correlations between the measured results
- To **propose** further research questions investigating more specific aspects of CI automation
- To **validate** the answers by means of interviews to developers
- To **compare** the occurrencies of bad practices in other CI tools

THANK YOU FOR YOUR ATTENTION.