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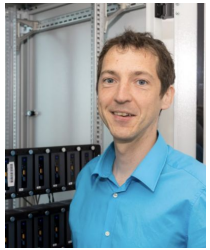
SOFTWARE
SYSTEME

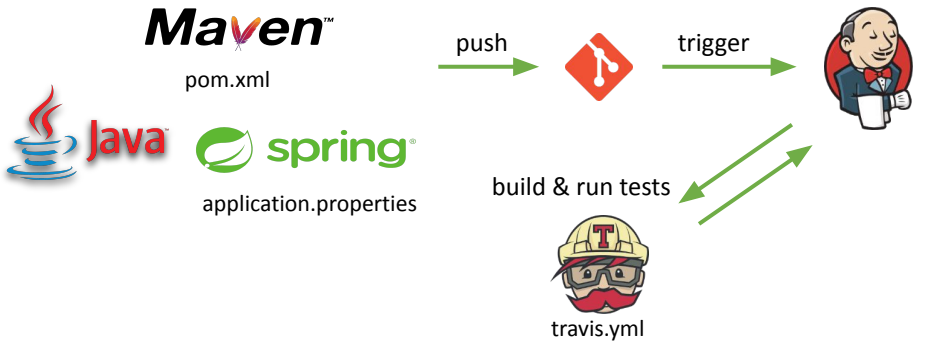
Detecting and Extracting Configuration Dependencies from Stack Overflow using LLMs

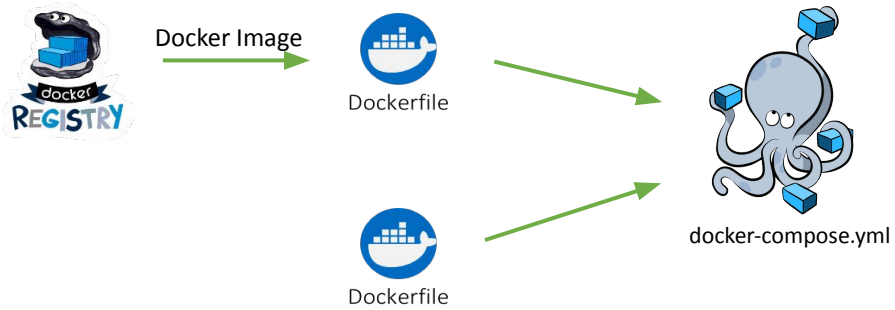
FOSD 2024, Eindhoven

Sebastian Simon



Technology Landscape in Modern Software Development





Dockerfile

```
FROM java:8
ADD example-app-1.0.jar app.jar
EXPOSE 8080
ENTRYPOINT [“java”, “-jar”, “/app.jar”]
```

application.properties

```
[…]
spring.application.name = example-app
server.port = 8080
[…]
```

docker-compose.yml

```
[…]
services:
   backend:
      ports: “8080:8080”
[…]
```

Stack Overflow – A Repository of Real-World Problems and Solutions

1 vote
2 answers
368 views

docker springboot only connects on postgres 5432 via docker-compose

Using **docker** to connect springboot to postgres via **docker-compose**. ... Using **port** 5432 on postgres works fine, if i try an **port** other than that it fails working code **spring**...

postgresql | spring-boot | docker | docker-compose — Chris Legge **769** asked Apr 17, 2019 at 20:33

1 vote
1 answer
1k views

Docker-compose, spring app + mongoDB on non-default port

Here is the **docker-compose** file: version: "3" services: olx-crawler: container_name: olx-crawler image: myimage:v1 ports: - "8099:8099" depends_on: - olx-mongo environment ... : DEBUG server: **port**: 8099...

spring | mongodb | docker | docker-compose — Biafra **93** asked Apr 15, 2020 at 18:08

1 vote
0 answers
1k views

How to expose docker container port into localhost port with docker-compose up?

I want to expose **docker** container **port** into localhost **port**. ... is how to expose **port** from **docker** container to e.g. localhost:8080 with **docker-compose**? ...

docker | docker-compose — Piotror **105** asked Jun 21, 2022 at 9:33

1 vote
2 answers
101 views

Spring Boot + MySQL Docker Compose: port exposure refused connection

Spring Boot + MySQL + **Docker** here. ... /gradlew clean bootJar && **docker-compose** --env-file .env up -d both MySQL and **Spring** Boot containers start up just fine but the **Spring** Boot API is not avail-...

spring-boot | docker | docker-compose — hotmeatballsoup **106** asked Mar 6, 2023 at 1:43

0 votes
4 answers
949 views

How to connect to docker-compose port from docker and locally?

I am using **spring** boot 2.5.3 and postgreSQL for backend. ... image **docker** build -t customer-image:v1 . , and run **docker-compose** build **docker-compose** up there are no error. ...

java | spring-boot | docker | docker-compose — wick3d **1,234** asked Aug 29, 2021 at 12:57

1 vote
2 answers
2k views

Spring Boot, Docker-Compose: Always defaults to port 80

I created my **docker** container using the suggested Dockerfile in **Spring** docs: FROM openjdk:8-jdk-alpine VOLUME /tmp ARG JAR_FILE COPY ${JAR_FILE} app.jar ENTRYPOINT ["java","-jar","/app.jar"]...

spring-boot | docker-compose — Karthik **477** asked Jul 26, 2020 at 17:59

1

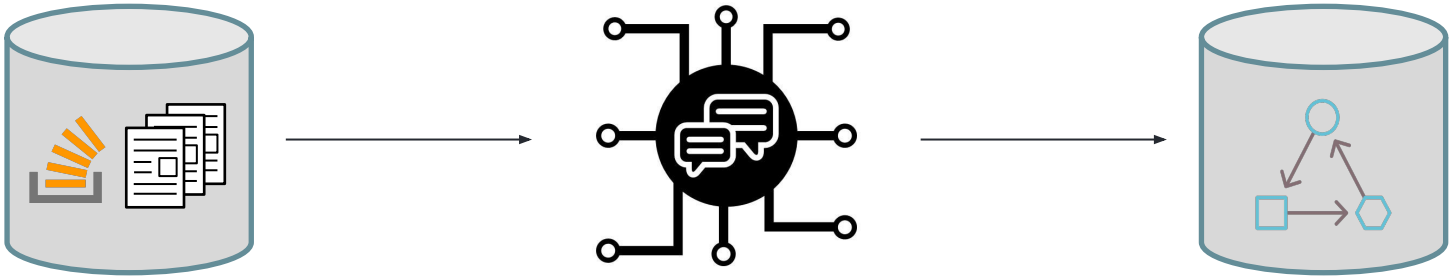
I have a problem with connecting to mongodb from my app. Here is the docker-compose file:

```yaml
version: "3"
services:
  olx-crawler:
    container_name: olx-crawler
    image: myimage:v1
    ports:
      - "8099:8099"
    depends_on:
      - olx-mongo
    environment:
      SPRING_DATA_MONGODB_HOST: olx-mongo

  olx-mongo:
    container_name: olx-mongo
    image: mongo
    ports:
      - "27777:27017"
    environment:
      MONGO_INITDB_ROOT_USERNAME: biafra
      MONGO_INITDB_ROOT_PASSWORD: password
```

And here is my application.yaml:

```yaml
spring:
  data:
    mongodb:
      host: localhost
      port: 27777
      username: biafra
      password: password
      authentication-database: admin

logging:
  level:
    org.springframework.data.mongodb.core.MongoTemplate: DEBUG
server:
  port: 8099
```

Methodology – Overall Approach

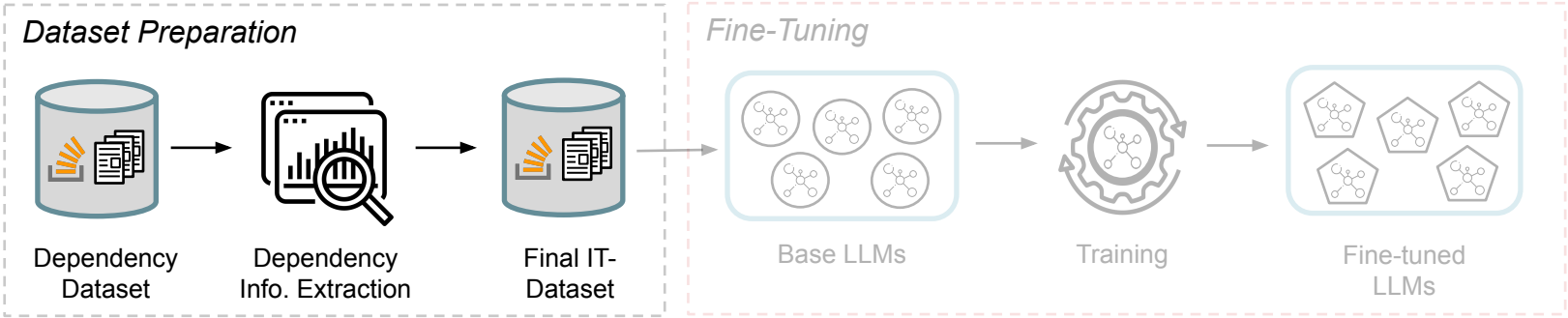


Stack Overflow (SO) Dataset

Dependency Extraction with Fine-Tuned LLMs

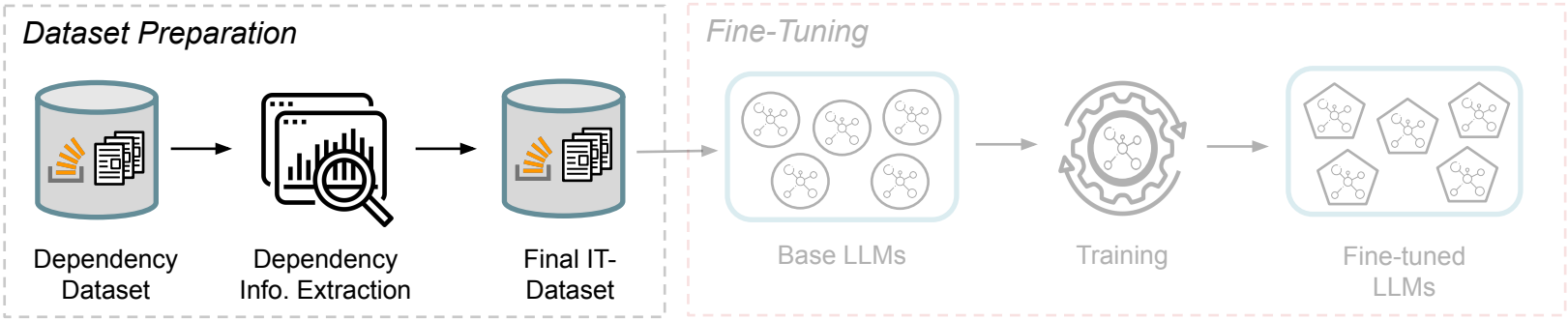
Real-World Dependency Dataset

Methodology – Fine-Tuning (1)



1. Enrich existing dependency dataset from SO [Simon et. al 2023]:
   - description of the dependency and its impact if violated
   - involved technologies, configuration files, options, and values

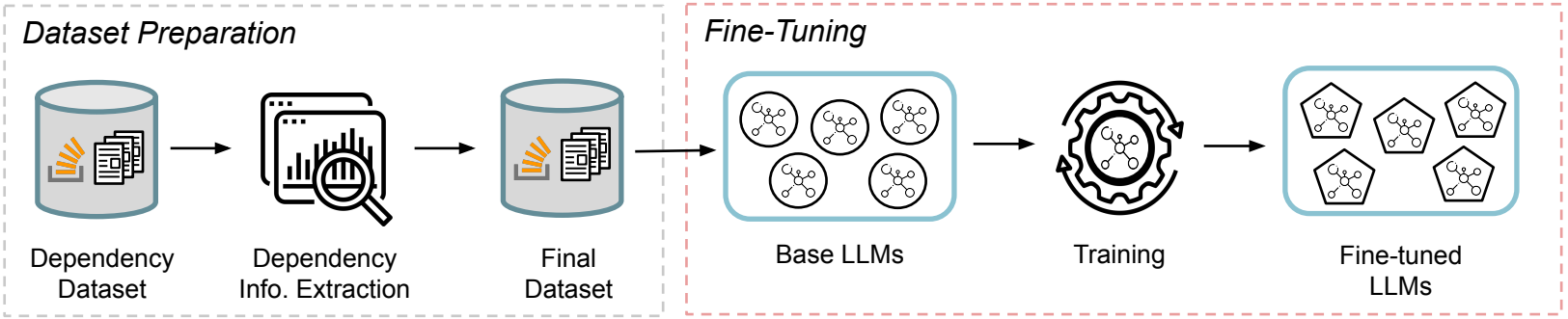
Methodology – Fine-Tuning (1)



2. Create Instruction-Tuning Dataset

```
ALPACA_PROMPT = """Below is an instruction that describes a task, paired with an Stack Overflow post that provides further context.
Write a response that appropriately completes the request.

### Instruction:
{}

### Stack Overflow post:
{}

### Response:
{}"""
```

Methodology – Fine-Tuning (2)



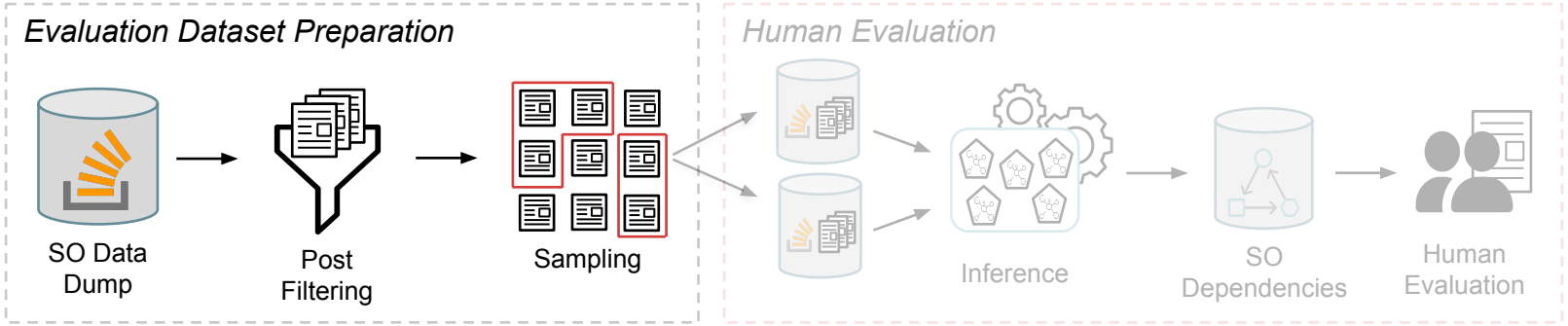
3. Fine-Tuning LLMs
   - **PEFT** (parameter-efficient fine-tuning)
   - LoRA and **QLoRa**

Transformers

PEFT

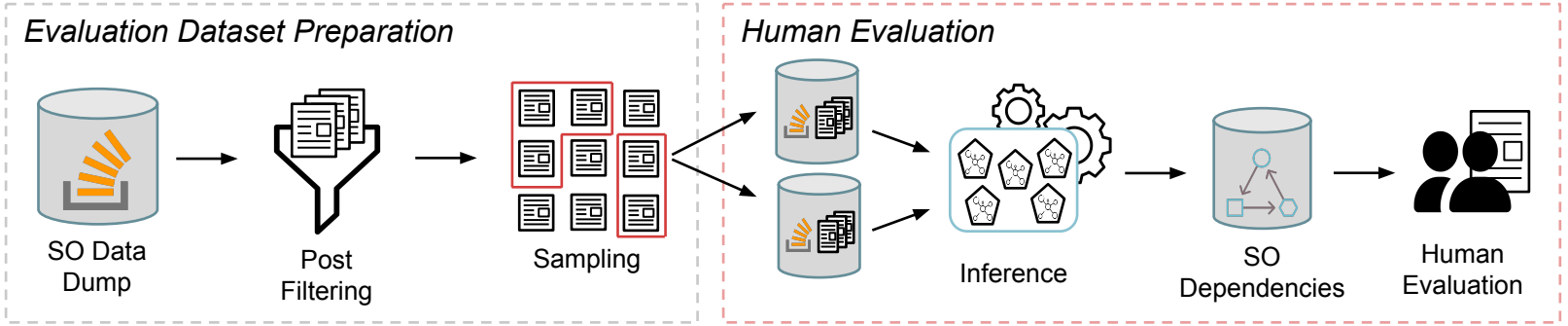
PyTorch

Methodology – Evaluation (1)



4. Select relevant SO posts using filter and sampling techniques
   - eval dataset with known technologies
   - eval dataset with unknown technologies

Methodology – Evaluation (2)



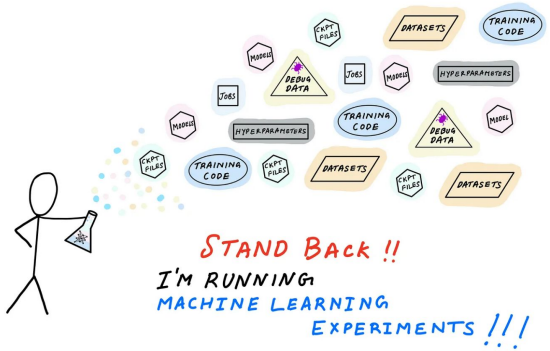
5. Evaluation of effectiveness and generalization capabilities via human assessment
   - count TP, FP, TN, and FN
   - measure precision and recall

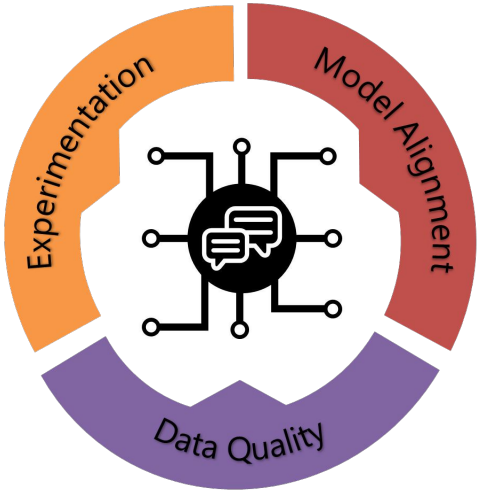
Preliminary Results

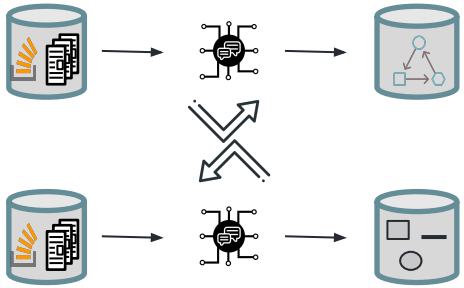
Model	fine-tuned	Precision	Recall
mistralai/Mistral-7B-Instruct-v0.1	no	0.12	0.19
	yes	0.08	0.07
	yes	0.14	0.16
	yes	0.2	0.07
	yes	0.13	0.04

- evaluation on **134 SO posts** with **known technologies**
- experiments with **different LoRA and hyperparameters**
- **tuning** hyperparameters **did not improve performance**

Challenges in Fine-Tuning LLMs







- guessing good parameters instead of systematic tuning
- too few examples, imbalanced dataset
- fine-tuning always incurs a penalty

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Questions for the audience..

Do you have already fine-tuned an LLM for a domain-specific task?
What are your experiences with fine-tuning?

Contact

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