МИНИСТЕРСТВО ОБРАЗОВАНИЯ РЕСПУБЛИКИ БЕЛАРУСЬ

УЧРЕЖДЕНИЕ ОБРАЗОВАНИЯ
«БРЕСТСКИЙ ГОСУДАРСТВЕННЫЙ ТЕХНИЧЕСКИЙ УНИВЕРСИТЕТ»

ФАКУЛЬТЕТ ЭЛЕКТРОННО-ИНФОРМАЦИОННЫХ СИСТЕМ

Кафедра интеллектуальных информационных технологий

Отчет по лабораторной работе No4

Специальность ПО11(о)

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Вариант 5

Цель работы: научиться работать с Github API, приобрести практические навыки написания программ для работы с REST API или GraphQL API

Общее задание: используя Github API, реализовать предложенное задание на языке Python. Выполнить визуализацию результатов, с использованием графика или отчета. Можно использовать как REST API (рекомендуется), так и GraphQL

Задание:
Построение карты взаимодействий разработчика на GitHub
Условие:
Напишите Python-скрипт, который:
1. Запрашивает у пользователя имя пользователя GitHub.
2. Использует API GitHub для получения списка всех репозиториев, в которых этот пользователь:
- Делал коммиты
- Открывал pull requests
- Создавал issues
- Ставил звёзды

3. Для каждого репозитория находит других разработчиков, с которыми пользователь взаимодействовал (например, авторы коммитов, ревьюеры pull requests, авторы issues).
4. Создаёт граф связей между пользователем и другими разработчиками.
5. Визуализирует граф с помощью networkx и matplotlib:
- Узлы (nodes) — пользователи
- Рёбра (edges) — взаимодействия (коммиты, PR, issues, звёзды)

6. Сохраняет граф в формате PNG/JPEG.

Выполнение:
Код программы:

main.py:
```
from api import fetch_github_data, generate_report
from graph_builder import build_interaction_graph
from visualizer import visualize_and_save_graph
from json_saver import save_graph_to_json

def get_github_username() -> str:
    return input("Введите имя пользователя GitHub: ").strip()

def main():
    username = get_github_username()
    print(f"Анализируем взаимодействия пользователя {username}...")

    # Получение данных через API
```

```
    repos_data = fetch_github_data(username)
    if not repos_data:
        print("Не удалось получить данные от GitHub API.")
        return

    # Генерация и вывод отчёта
    report = generate_report(username, repos_data, f"{username}_github_report.txt")
    print("\n" + report)
    print(f"\nТекстовый отчёт сохранён в {username}_github_report.txt")

    # Построение графа взаимодействий
    graph = build_interaction_graph(username, repos_data)
    print(f"\nНайдено {len(graph.nodes)-1} связанных разработчика.")

    # Сохранение графа в JSON
    save_graph_to_json(graph, f"{username}_github_network.json")

    # Визуализация графа
    visualize_and_save_graph(graph, f"{username}_github_network.png")

if __name__ == "__main__":
    main()
```

api.py:

```
import requests
from const import GITHUB_TOKEN, GITHUB_API_URL


def fetch_github_data(username: str):
    """Fetch GitHub user interaction data including repos, contributions and stars."""
    headers = {"Authorization": f"token {GITHUB_TOKEN}"} if GITHUB_TOKEN else {}

    try:
        user_repos = _fetch_user_repositories(username, headers)
        if not user_repos:
            print("Пользователь не имеет репозиториев.")
            return None

        contributed_prs = _fetch_user_pull_requests(username, headers)
        data = _initialize_data_structure()

        _process_user_repositories(user_repos, username, headers, data)
        _process_contributions(contributed_prs, headers, data)
        _fetch_user_stars(username, headers, data)

        return data

    except requests.exceptions.RequestException as e:
        print(f"Ошибка при запросе к GitHub API: {str(e)}")
        return None


def _fetch_user_repositories(username: str, headers: dict) -> list:
    """Fetch all user repositories including forks."""
    url = f"{GITHUB_API_URL}/users/{username}/repos?type=all"
    response = requests.get(url, headers=headers, timeout=10)
```

```
    if response.status_code != 200:
        print(f"Ошибка при запросе репозиториев: {response.status_code}")
        print(f"Ответ сервера: {response.text}")
        return []

    return response.json()


def _fetch_user_pull_requests(username: str, headers: dict) -> list:
    """Fetch user's pull requests in other repositories."""
    url = f"{GITHUB_API_URL}/search/issues?q=author:{username}+type:pr"
    response = requests.get(url, headers=headers, timeout=10)
    return response.json().get("items", []) if response.status_code == 200 else []


def _initialize_data_structure() -> dict:
    """Initialize the data structure for storing GitHub interactions."""
    return {
        "repos": [],  # Собственные репозитории
        "contributions": [],  # Участие в чужих репозиториях
        "stars": []  # Звёзды
    }


def _process_user_repositories(repos: list, username: str,
                               headers: dict, data: dict) -> None:
    """Process user repositories and collect interaction data."""
    for repo in repos:
        repo_name = repo["full_name"]
        repo_data = {
            "name": repo_name,
            "commits": _fetch_repository_commits(repo_name, username, headers),
            "pull_requests": _fetch_repository_pull_requests(repo_name, headers),
            "issues": _fetch_repository_issues(repo_name, headers)
        }
        data["repos"].append(repo_data)

        if repo.get("fork"):
            _process_forked_repository(repo, repo_name, headers, data)


def _process_forked_repository(repo: dict, repo_name: str,
                               headers: dict, data: dict) -> None:
    """Process forked repository and find pull requests to parent."""
    parent = repo.get("parent")
    if parent:
        parent_repo = parent["full_name"]
        prs = _fetch_pull_requests_from_fork(repo_name, parent_repo, headers)
        if prs:
            data["contributions"].extend(prs)


def _process_contributions(prs: list, headers: dict, data: dict) -> None:
    """Process user contributions to other repositories."""
    for pr in prs:
        repo_url = pr["repository_url"]
        repo_name = "/".join(repo_url.split("/")[-2:])
        pr_data = {
```

```
            "repo": repo_name,
            "user": pr["user"]["login"],
            "reviewers": _get_pull_request_reviewers(repo_name, pr["number"], headers)
        }
        data["contributions"].append(pr_data)


def _fetch_user_stars(username: str, headers: dict, data: dict) -> None:
    """Fetch repositories starred by the user."""
    url = f"{GITHUB_API_URL}/users/{username}/starred"
    response = requests.get(url, headers=headers, timeout=10)
    if response.status_code == 200:
        data["stars"] = [repo["owner"]["login"] for repo in response.json()]


def _fetch_repository_commits(repo_name: str, username: str,
                              headers: dict) -> list:
    """Fetch commits for a specific repository."""
    url = f"{GITHUB_API_URL}/repos/{repo_name}/commits?author={username}"
    response = requests.get(url, headers=headers, timeout=10)
    if response.status_code == 200:
        return list({commit["author"]["login"]
                     for commit in response.json()
                     if commit.get("author")})
    return []


def _fetch_repository_pull_requests(repo_name: str, headers: dict) -> list:
    """Fetch pull requests for a specific repository."""
    url = f"{GITHUB_API_URL}/repos/{repo_name}/pulls?state=all"
    response = requests.get(url, headers=headers, timeout=10)
    if response.status_code == 200:
        return [{
            "user": pr["user"]["login"],
            "reviewers": [r["login"] for r in pr.get("requested_reviewers", [])]
        } for pr in response.json()]
    return []


def _fetch_pull_requests_from_fork(fork_name: str,
                                   parent_repo: str,
                                   headers: dict) -> list:
    """Fetch pull requests from a fork to its parent repository."""
    owner, branch = fork_name.split('/')
    url = (f"{GITHUB_API_URL}/repos/{parent_repo}/pulls"
           f"?state=all&head={owner}:{branch}")
    response = requests.get(url, headers=headers, timeout=10)
    if response.status_code == 200:
        return [{
            "repo": parent_repo,
            "user": pr["user"]["login"],
            "reviewers": _get_pull_request_reviewers(parent_repo, pr["number"],
headers)
        } for pr in response.json()]
    return []


def _get_pull_request_reviewers(repo_name: str,
                                pr_number: int,
```

```
                                headers: dict) -> list:
    """Fetch reviewers for a specific pull request."""
    url = f"{GITHUB_API_URL}/repos/{repo_name}/pulls/{pr_number}/reviews"
    response = requests.get(url, headers=headers, timeout=10)
    if response.status_code == 200:
        return list({review["user"]["login"]
                     for review in response.json()
                     if review.get("user")})
    return []


def _fetch_repository_issues(repo_name: str, headers: dict) -> list:
    """Fetch issues for a specific repository."""
    url = f"{GITHUB_API_URL}/repos/{repo_name}/issues?state=all"
    response = requests.get(url, headers=headers, timeout=10)
    if response.status_code == 200:
        return list({issue["user"]["login"]
                     for issue in response.json()
                     if issue.get("user")})
    return []


def generate_report(username: str, data: dict, filename: str) -> str:
    """Generate and save a text report of user interactions."""
    report = f"Отчёт по взаимодействиям пользователя {username}:\n\n"

    # Коммиты
    commit_repos = {repo["name"] for repo in data["repos"] if repo["commits"]}
    report += f"Репозитории с коммитами ({len(commit_repos)}):\n"
    report += "\n".join(f"- {repo}" for repo in commit_repos) + "\n\n"

    # Pull Requests
    pr_repos = {repo["name"] for repo in data["repos"] if repo["pull_requests"]}
    pr_repos.update(contrib["repo"] for contrib in data["contributions"])
    report += f"Репозитории с Pull Requests ({len(pr_repos)}):\n"
    report += "\n".join(f"- {repo}" for repo in pr_repos) + "\n\n"

    # Issues
    issue_repos = {repo["name"] for repo in data["repos"] if repo["issues"]}
    report += f"Репозитории с Issues ({len(issue_repos)}):\n"
    report += "\n".join(f"- {repo}" for repo in issue_repos) + "\n\n"

    # Stars
    report += f"Репозитории с звёздами ({len(data['stars'])}):\n"
    report += "\n".join(f"- {owner}" for owner in data["stars"]) + "\n\n"

    with open(filename, "w", encoding="utf-8") as f:
        f.write(report)

    return report
```

const.py:

```
import os

GITHUB_TOKEN = os.getenv("GITHUB_TOKEN")
GITHUB_API_URL = "https://api.github.com"
```

graph_builder.py:

```
import networkx as nx


def build_interaction_graph(username: str, data: dict) -> nx.Graph:
    """
    Builds an interaction graph for a GitHub user based on their activities.

    Args:
        username: GitHub username
        data: Dictionary containing user's repositories, contributions and stars

    Returns:
        NetworkX Graph object representing user's interactions
    """
    G = nx.Graph()
    G.add_node(username, type="user")

    _add_repository_interactions(G, username, data["repos"])
    _add_contribution_interactions(G, username, data["contributions"])
    _add_star_interactions(G, username, data["stars"])

    return G


def _add_repository_interactions(graph: nx.Graph, username: str, repos: list) -> None:
    """Add interactions from user's own repositories."""
    for repo in repos:
        _add_commit_interactions(graph, username, repo["commits"])
        _add_pull_request_interactions(graph, username, repo["pull_requests"])
        _add_issue_interactions(graph, username, repo["issues"])


def _add_contribution_interactions(graph: nx.Graph, username: str, contributions: list)
-> None:
    """Add interactions from contributions to other repositories."""
    for contribution in contributions:
        _add_contribution_edge(graph, username, contribution["user"], "contribution")
        _add_reviewer_edges(graph, username, contribution["reviewers"],
"contribution_review")


def _add_star_interactions(graph: nx.Graph, username: str, stars: list) -> None:
    """Add interactions from starred repositories."""
    for owner in stars:
        _add_star_edge(graph, username, owner)


def _add_commit_interactions(graph: nx.Graph, username: str, commits: list) -> None:
    """Add commit interactions to the graph."""
    for author in commits:
        _add_edge_if_valid(graph, username, author, "commit")


def _add_pull_request_interactions(graph: nx.Graph, username: str, pull_requests: list)
-> None:
    """Add pull request interactions to the graph."""
    for pr in pull_requests:
```

```
        _add_edge_if_valid(graph, username, pr["user"], "pull_request")
        _add_reviewer_edges(graph, username, pr["reviewers"], "pr_review")


def _add_issue_interactions(graph: nx.Graph, username: str, issues: list) -> None:
    """Add issue interactions to the graph."""
    for user in issues:
        _add_edge_if_valid(graph, username, user, "issue")


def _add_reviewer_edges(graph: nx.Graph, username: str, reviewers: list, edge_type:
str) -> None:
    """Add reviewer edges to the graph."""
    for reviewer in reviewers:
        _add_edge_if_valid(graph, username, reviewer, edge_type)


def _add_contribution_edge(graph: nx.Graph, username: str, user: str, edge_type: str) -
> None:
    """Add a contribution edge to the graph."""
    _add_edge_if_valid(graph, username, user, edge_type)


def _add_star_edge(graph: nx.Graph, username: str, owner: str) -> None:
    """Add a star edge to the graph."""
    _add_edge_if_valid(graph, username, owner, "star")


def _add_edge_if_valid(graph: nx.Graph, source: str, target: str, edge_type: str) ->
None:
    """
    Add an edge to the graph if target is valid and not the same as source.

    Args:
        graph: NetworkX Graph to add edge to
        source: Source node
        target: Target node
        edge_type: Type of interaction/edge
    """
    if target and target != source:
        graph.add_edge(source, target, type=edge_type)
```

json_saver.py:

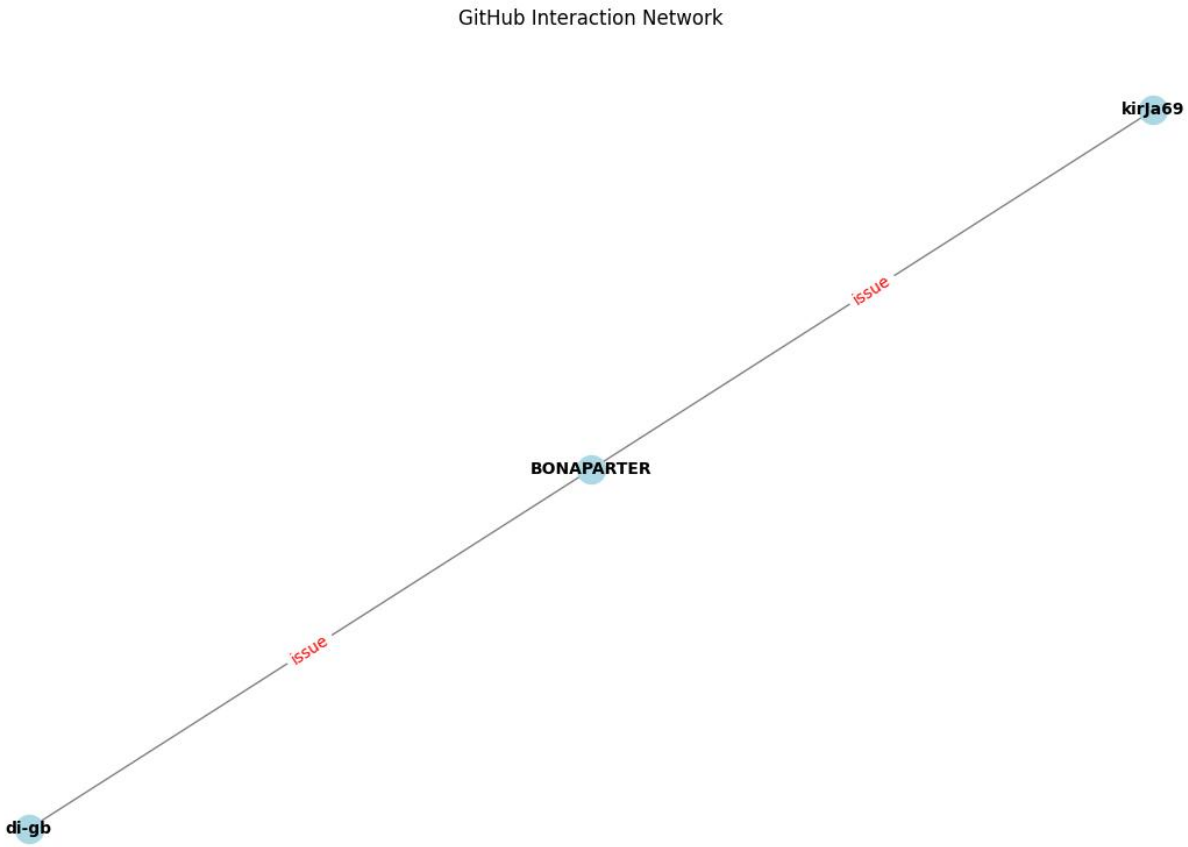
```
import json

def save_graph_to_json(graph, filename: str):
    graph_data = {
        "nodes": [{"id": node, "type": graph.nodes[node].get("type", "unknown")} for
node in graph.nodes],
        "edges": [{"source": u, "target": v, "type": d["type"]} for u, v, d in
graph.edges(data=True)],
    }
    with open(filename, "w", encoding="utf-8") as file:
        json.dump(graph_data, file, ensure_ascii=False, indent=4)
    print(f"Граф сохранён в {filename}")
```

visualizer.py:

```
import matplotlib.pyplot as plt
import networkx as nx

def visualize_and_save_graph(G, filename: str):
    plt.figure(figsize=(12, 8))
    pos = nx.spring_layout(G)

    # Рисуем узлы
    nx.draw_networkx_nodes(G, pos, node_size=300, node_color="lightblue")
    nx.draw_networkx_labels(G, pos, font_size=10, font_weight="bold")

    # Рисуем рёбра
    edge_labels = nx.get_edge_attributes(G, 'type')
    nx.draw_networkx_edges(G, pos, width=1.0, alpha=0.5)
    nx.draw_networkx_edge_labels(G, pos, edge_labels=edge_labels, font_color='red')

    plt.title("GitHub Interaction Network")
    plt.axis("off")
    plt.tight_layout()

    # Сохранение графика
    plt.savefig(filename)
    print(f"Визуализация графа сохранена в {filename}")
    plt.show()
```

Результаты работы программы:

```
Введите имя пользователя GitHub: BONAPARTER
Анализируем взаимодействия пользователя BONAPARTER...

Отчёт по взаимодействиям пользователя BONAPARTER:

Репозитории с коммитами (8):
- BONAPARTER/spp_po11
- BONAPARTER/Mobile-development
- BONAPARTER/task_manager
- di-gb/tg_bot_test
- BONAPARTER/Tests
- BONAPARTER/Json_data
- BONAPARTER/KPO
- BONAPARTER/Tic-tac-toe

Репозитории с Pull Requests (2):
- kroschenko/spp_po11
- di-gb/tg_bot_test

Репозитории с Issues (1):
- di-gb/tg_bot_test

Репозитории с звёздами (0):



Текстовый отчёт сохранён в BONAPARTER_github_report.txt

Найдено 2 связанных разработчика.
Граф сохранён в BONAPARTER_github_network.json
Визуализация графа сохранена в BONAPARTER_github_network.png
```



BONAPARTER_github_network.json BONAPARTER_github_report.txt

```
Отчёт по взаимодействиям пользователя BONAPARTER:

Репозитории с коммитами (8):
- BONAPARTER/spp_po11
- BONAPARTER/Mobile-development
- BONAPARTER/task_manager
- di-gb/tg_bot_test
- BONAPARTER/Tests
- BONAPARTER/Json_data
- BONAPARTER/KPO
- BONAPARTER/Tic-tac-toe

Репозитории с Pull Requests (2):
- kroschenko/spp_po11
- di-gb/tg_bot_test

Репозитории с Issues (1):
- di-gb/tg_bot_test

Репозитории с звёздами (0):
```

Вывод: научился работать с Github API, а также визуализировать зависимости между пользователями.