DNAnalyzer - an online & interactive game on DNA data analysis

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Introduction

DNA
RNA
Variants
Mutations
Sequencing
...

...
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DNA
RNA
Variants
Mutations
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...

- **Street Science Community** - a group of researchers and teachers in Freiburg trying to bring DNA, sequencing, metagenomics and in general the scientific process closer to citizens.

- **DNAnalyzer** - an encouraging and easy-to-understand online game on DNA data analysis.
DNAnalyzer in the previous

Index page:

Quiz page:
My aims

1. Rewrite the website front-end.
   a. Improve the website (clean design, layout, CSS, etc)

2. Develop a back-end to support
   a. Our own login/sign-up system.
   b. Serve quiz and results by itself instead of google forms.

3. Set up a database to
   a. Store quiz questions, results and user informations.
   b. Make it not too complex so contributor can submit new questions.

4. Integrate with existing game level 1 and set up the next level.
   a. Integrate the Galaxy workflow comparison tool (Siyu's tool) to the level 2.
   b. Make it easier to add new levels.
Website demo
Implementations

System architecture
Front-end

Frontend
Website using Flask Templates

User Auth & Game tracking requests and responses

Backend
Python Flask

User, quiz questions details data retrieval & store

Database
PostgreSQL

return the score for comparison

Python tool for Galaxy comparison

request to compare shared galaxy histories.
Front-end: Index Page

before:

now:
Front-end: Quiz Page

before:

now:
Front-end: Quiz Result Page

**Before:**

```
Quiz

Your Username (use the same Username at all levels) *

What is the proper definition of evolution? *

- changes in a population of organisms over a period of time
- changes in individual organisms during their lifetime
- organisms coming into existence at a defined moment in time and not changing

Correct answer:
- changes in a population of organisms over a period of time

Feedback
Evolution is a change in a population of organisms through time leading to the appearance of new forms

What are biological survival benefits for a population? *

- genetic disease
- high mutation rate
- environmental changes
- niche advantages like the lizards' ability to change a color

Correct answers:
- high mutation rate
- niche advantages like the lizards' ability to change a color

Feedback
Adaptation occurs throughout the natural world. Some mutations are beneficial and increase the possibility that an organism will thrive and pass on its genes to the next generation. Others may improve survival or reproduction, the process of natural selection will favor the mutations that become more common over time. Therefore, mutations can be beneficial if they increase the likelihood of survival and reproduction. In this image, the correct answer is environmental changes because it reflects the changes that can occur in a population over time, which is crucial for survival. They are not as easy to find in animals as would like to think these and therefore can survive longer than other species.
```
Database

Diagram:
- **Frontend**
  - Website using Flask Templates
- **Backend**
  - Python Flask
  - User Auth & Game tracking requests and responses
- **Database**
  - PostgreSQL
  - User, quiz questions details, data retrieval & store
  - Python tool for Galaxy comparison

Interactions:
- User Auth & Game tracking
- User, quiz questions details, data retrieval & store
- Python tool for Galaxy comparison
Database

relational diagram
Yaml file

```yaml
chapter_name: Introduction to the biology

video_url: Y_8swKF-YHY

total_score: 54

questions:
  # 1
  - title: What is the proper definition of evolution?
    type: choose_one
    hint: Even though evolution is taking place all around us...
    explanation: Evolution is a change in a population of organisms...
    image_name: 
    point: 4
    choices:
      - 1: changes in a population of organisms over a period of time
        correct: true
      - 2: changes in individual organisms during their lifetime
        correct: false
      - 3: organisms coming into existence at a defined moment in time...
        correct: false
```

Quiz yaml file example
Back-end

- **Frontend**: Website using Flask Templates
- **Backend**: Python Flask
- **Database**: PostgreSQL

User Auth & Game tracking requests and responses

User, quiz questions details data retrieval & store

返 the score for comparison

request to compare shared galaxy histories.

Python tool for Galaxy comparison
Github and documentations

- **Github** ([https://github.com/StreetScienceCommunity/DNAnalyzer](https://github.com/StreetScienceCommunity/DNAnalyzer)):
  - Code repository
  - Pull requests
  - Issues
  - Code reviews

- **Documentations**
  - Code comments
  - Readme file
  - Deployment instructions
  - Contribution instructions
  - Database designs
  - User interface designs
What missing now?

- Integration with galaxy workflow evaluation tool
- Deployment on a server

Future development

- Level 3 of the game
Summary
Thank You!