

Second Iteration Report

Team name: Hooli

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Part 0: Language, Platform and Technologies

We would like to choose Python as our language, and Mac OS as our developing environment. In addition, we would like to integrate multiple cutting-edge technologies into our project, including but not limited to Tensorflow, Keras, and various AWS services, such as Elastic Beanstalk, API Gateway, DynamoDB, S3, Cognito, etc., If we have enough time to do so.

Github Link: <https://github.com/ysun647/Nucleus>

The version for the second iteration was tagged as v2.0.

Part 1: Project Summary

[SQuAD challenge](#), raised by Stanford University is a famous and popular reading comprehension problem. The target of SQuAD challenge, is to train a neural network that is able to answer a specific question, given a passage from Wikipedia which contains the answer of this question, or to output that this question is not answerable, if the given passage does not contains the answer. Stanford University provides training datasets to the public, and researchers all over the world are trying the best on their networks to approaching the human's performance - it's almost there.

In our project, we are planning to do three cool things related to SQuAD; first, design a web crawler to collect data from Wikipedia as the training and testing dataset; second, train and test a deep neural network based on the SQuAD challenge; third, if we have enough time, we will try to design a web application and deploy it based on Amazon Web Service, and thus allow our users to test our network and submit feedbacks.

Part 2: Some User Stories

1. General Web Surfer: As a guy surfing the Internet, I want an answer of a specific question based on the web pages I am looking through within several seconds so that it saves my time on searching for the answer. My conditions of satisfaction are that it could output the answer within 3 seconds, or output "no answer" if the answer does not exist.
2. Students: As a student who suffers from difficulty in reading, I want to extract the key information in some long articles. My conditions of satisfaction are I can get the short answer immediately avoid reading the whole article.

3. Developers: As a developer, I want to pinpoint my technical issue inside a technical documentation so that I don't need to look through all of it. My conditions of satisfaction are that I can find what I want immediately."

Part 3: User-level Test Cases

A user of our product may

- Sign up a new account;
- Sign in to an existing account;
- Type in an article and ask a related question;
- Select an article and ask a related question;
- Ask a question, whose answer cannot be found in the article;
- Input a meaningless message or a meaningless question;
- Sign out the currently signed-in account;

Workflow Exceptions (error cases)

- No account / password incorrect;
- Empty question or article;
- Irrelevant question;
- Question is too long;
- Article is too long;

Part 4: Use Cases

In this part we show some use cases that is expanded or merged from the user stories listed above.

Use case 1

1. **Title:** Account signing up
2. **Actor(s):** regular users
3. **Descriptions:** Regular users can sign up an account to access the functionality offered by our website. Username and password format as well as verification code are required. Automatically logged on after successful registration.
4. **Triggers:** Regular users click "sign up" in the welcome page.
5. **Preconditions:** the regular user is not registered.
6. **Guarantees:** the regular user becomes a register player and automatically logged in.
7. **Basic flows:**
 - a. System provides several blank editor area asking user to fill in registration information.
 - b. Regular user types in the required information: username, password, email address.
 - c. The regular user clicks the signup button to confirm and proceed to next steps.

- d. System calls cognito module to check if the username has existed or not.
 - e. System validates the password in view of length is longer than 8 as well as special symbols; email in view of the email format.
 - f. The system sends verification code to user's email and redirects the user to verification page.
 - g. User types the verification code into the required blank.
 - h. The system sets up connection between mysql server on Amazon RDS to store the same user information.
 - i. The user becomes a registered one and automatically signed in.
8. **Alternate flows:**
- D1. The username has already existed. The system notifies the user with a message: 'username already existed.'
 - E1. The password length is smaller than 8. System notifies the user with a message: 'password too short!'
 - E2. The password or usernames contains some special symbols. System redirects to an error page which display the errors to be corrected.
 - E3. The email address has invalid formats. System redirects to an error page which display the errors to be corrected.
 - G1. The verification code is incorrect. System prints out message: 'unable to verify, please try again.'

Use case 2

1. **Title:** Account signing in
2. **Actor(s):** Registered users
3. **Descriptions:** Registered user can sign in an existed account to access the functionality offered by our website.
4. **Triggers:** User click "LOGIN" in the login page.
5. **Precondition:** The user is not yet logged in.
6. **Basic flows:**
 - a. System provides several blank editor area asking user to fill in login information.
 - b. User types his/her user name;
 - c. User types his/her password;
 - d. System checks if the given login parameters are valid;
 - e. System creates a new session for the user.
7. **Alternate flows:**
 - c1. The user name that user provides is not registered -> login failed -> System informs the user that he/she typed a non-registered user name and redirects to the login page.
 - c1. The password that user provides is incorrect -> login failed -> System informs the User that he/she typed an incorrect password and redirects to the login page.
8. **Success guarantees:** The user can access the main page to take further operations.

Use case 3

1. **Title:** Account asking general question
2. **Actor(s):** Registered users
3. **Descriptions:** A user logs in and asks a general question, without providing a related context. In this case, we call the API of wikipedia to find the potential answer.
4. **Basic flows:**
 - a. The user logs in to Nucleus system.
 - b. The user clicked "I want to ask a questions without context"
 - c. The user input a question, such as "Where is New York City", and clicked "submit".
 - d. The system called the wikipedia API, try to find the basic introduction of "New York City", and put this article to our neural model.
 - e. The pre-trained neural model use the article provided by wikipedia API and the question from the user as input, and then suggests a possible answer.
 - f. The user's action of asking question is recorded and sent to our database on Amazon RDS.
 - g. The user see the suggested answer on the webpage.
 - h. The user clicked "go back to main page"
 - i. The user logged out.
5. **Alternate flows:**
 - c1. The user provided a question that contains an ambiguous keyword. For example, When the user asks "Where is New York?", "New York" may refer to New York City or New York State. In this case we will try to find answer in both the wikipedia page of "New York City" and "New York State".
 - c2. The user may input an empty question. In this case, we will suggest a warning saying that empty questions are not allowed.
 - h1. The user may close the webpage directly without logging out. In this case, we will still maintain the session for a short time until the http connection is time out, thus we provide convenience in case when a user come back in a short time - this user does not need to log in again.

Use case 4

1. **Title:** Account asking questions and providing context
2. **Actor(s):** Registered users
3. **Descriptions:** A user logs in and asks a question providing a related context. In this case, we put the context and question, expecting a correct answer extracted from the context, None if no answer found.
4. **Basic flows:**
 - a. The user logs in to Nucleus system.
 - b. The user clicked "I want to ask a questions with context"

- c. The user input a question, such as “Where is New York City”, provided a context, and clicked “submit”.
 - d. The pre-trained neural model uses the article provided by wikipedia API and the question from the user as input, and then suggests a possible answer.
 - e. The user’s action of asking question is recorded and sent to our database on Amazon RDS.
 - f. The user see the suggested answer on the webpage.
 - g. The user clicked “go back to main page”
 - h. The user logged out.
5. **Alternate flows:**
- c1. The user may provide an unrelated context, which does not contain the answer to the question. In this case, Nucleus suggests “no answer” to the user.
 - c2. The user may input an empty question. In this case, we will suggest a warning saying that empty questions are not allowed.
 - h1. The user may close the webpage directly without logging out. In this case, we will still maintain the session for a short time until the http connection is time out, thus we provide convenience in case when a user come back in a short time - this user does not need to log in again.

Part 5: Test Suites

Test suite of neural model

We divide all the test cases of neural models into the following test cases. All of the test cases are in the <root>/testcases directory.

1. Meaningful questions and contexts. This suite includes test cases composed of meaningful questions, meaningful contexts, and the answer of this question is in the contexts.
2. Meaningless questions and contexts. This suite includes test cases in which the questions are not related to the context; that is, we cannot find the answer related to the question.
3. Nonsense questions and contexts. This suite includes test cases that does not make any sense.
4. Explainable nonsense. This suite includes test cases that contains some nonsense word, but it is explainable anyway. For example, say the context contains a sentence “the rf8gnv9wgtcw is the governor of State Cderefbuer”. Despite that “rf8gnv9wgtcw” does not make any sense, it is explainable anyway.
5. Injection attack. This suite includes test cases that may be related to injection attacks, such as “sudo rm -rf /” or “drop database”

Test suite of database

For the database unit tests which are located in the file <root>/test/test_database.py, we originally have 5 methods in database class (the last one which is called get_history_list has not been fully developed yet so no test cases for that). We design valid and invalid test cases for each methods, as described below.

1. Valid input cases with all the required parameters. Specifically, we pass in
 1. article content and article title for add_article method;
 2. user_name, user_password, user_email for add_user method;
 3. art_id, q_content for add_question method;
 4. U_id, q_id for add_history method;
 5. User_id, title, content, question for update method
2. Invalid input test cases with some required parameters missing or wrong formatted
 1. Missing article content or missing content title for add_article method;
 2. Long titles for add_article method;
 3. Missing user_name, user_password or user_email for add_user method;
 4. Missing u_id or q_id for add_history method;
 5. Bound conditions (0 index) for add_history method;
 6. Negative index for add_history method;
 7. Missing art_id or q_content for add_question method;
 8. Negative article id or string id for add_question method;
 9. Long questions for add_question method;
 10. Missing User_id, title, content or question for update method;
 11. Long input for update method.

Part 6: Coverage Test

We are using package `coverage` to see the coverage of our test cases. The commands about it is stored in our repo's following path:

```
<root>/results/post-commit-build-shell.txt
```

The results are as follows as well as in the repository (<root>/coverage_report.txt):

Name	<u>Stmts</u>	Miss	Cover
-----	-----	-----	-----
config.py	6	0	100%
database/db_update_class.py	90	33	63%
models/r_net/func.py	153	42	73%
models/r_net/inference.py	184	5	97%
models/r_net/ <u>prepro.py</u>	187	161	14%
test/test_database.py	235	5	98%
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TOTAL	855	246	71%

Basically, our branch coverage rate is about 71% for several reasons:

1. Some of the modules are not covered in this test, because these modules are used for training the model, not for implementing the whole system. When Nucleus is launched, these modules will not be called. This is why 161 lines are missing from prepro.py and 42 lines are missing from func.py.
2. There is one extension database function in db_update_class.py, which is still under development. So we haven't written any test cases for this method. This is why we have 33 lines missing in this file.
3. We didn't take the front end (flask based) code coverage into consideration according to IA's suggestion.

