Programming Assignment 1

Vector Space Model

Web Retrieval and Mining

Spring 2025

2025/3/21

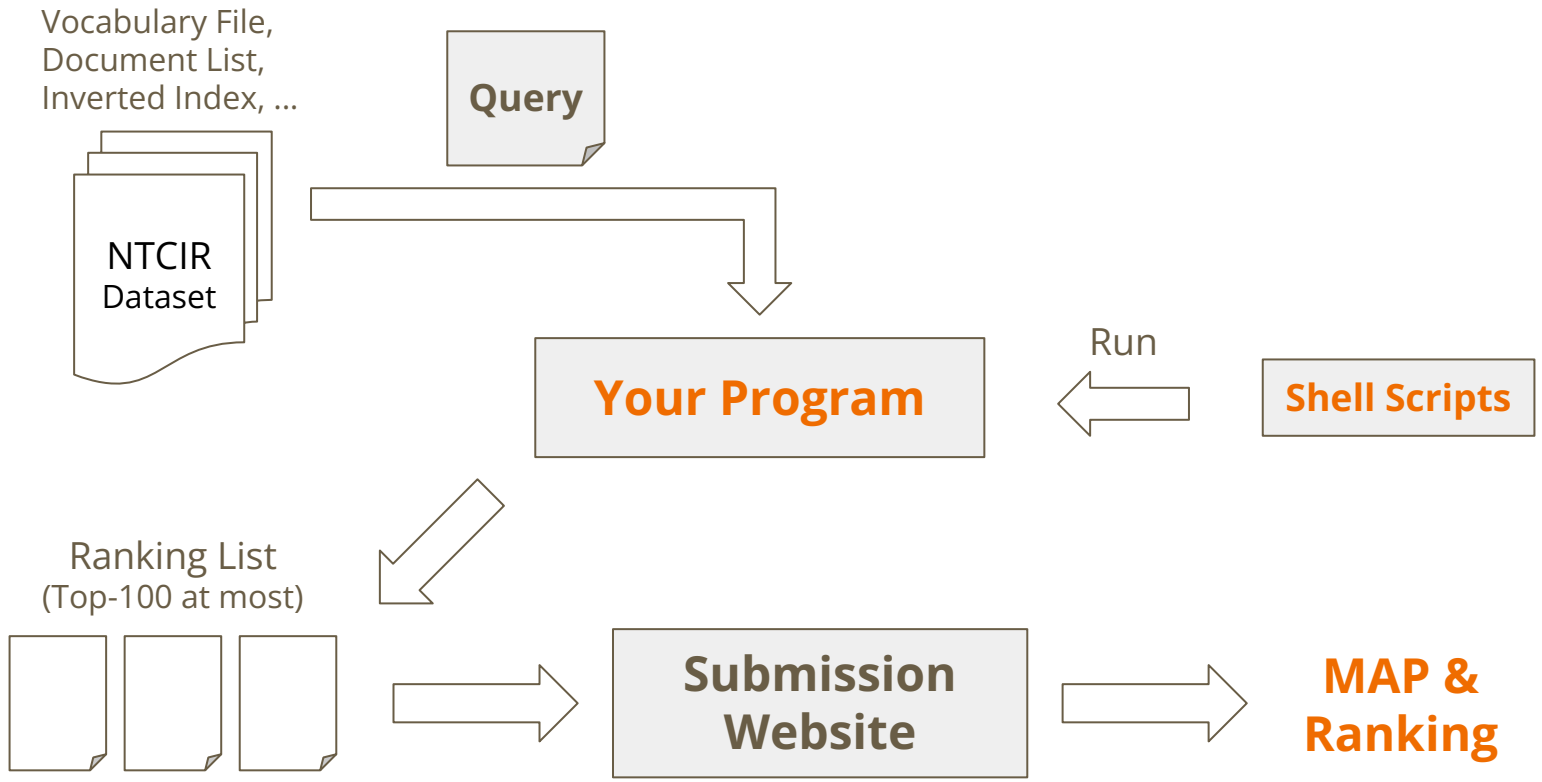
Updates

- 3/26 Update: added a new baseline, and adjusted the score weighting
- 4/07 Update: match report and agreement form deadline to NTU COOL
- (Any updates will be listed here.)

Introduction

- In this homework, you are asked to implement **a small information retrieval system**.
- We will give you a bunch of Chinese news articles and several queries in NTCIR format, and your task is to find the relevant documents among these articles according to the given queries.
- You should implement the retrieval system by **Vector Space Model** (VSM) with **Rocchio Relevance Feedback** (pseudo version).

Overview


Vocabulary File,
Document List,
Inverted Index, ...
NTCIR
Dataset
Query
Your Program
Run
Shell Scripts
Ranking List
(Top-100 at most)
Submission
Website
MAP &
Ranking

NTCIR Document Set

- Please sign up the **USER AGREEMENT FORM** and upload to the COOL Assignment Section in order to use this corpus. (DEADLINE: 2025/4/7 11:59:59 (UTC+8))
  - Note that you'll get **NO POINTs** if you don't sign up the user agreement form.
  - **DO NOT distribute** this dataset
- Download NTCIR document set on kaggle.
- We have indexed the NTCIR documents and produced three MODEL FILES for you:
  - vocab.all
  - file-list
  - inverted-file

NTCIR Document Format

- The NTCIR document format conforms to XML1.0, and make use a limited set of tags to represent different semantic levels of newswire texts.
- The root element is <xml>, it contains only one <doc> tag
- A <doc> tag represents exactly one newswire article, in which several sub-elements are used to specify different type of information:
  - <id>: An unique document ID.
  - <date>: The publication date.
  - <title>: The title of the article.
  - <text>: The content of the article, which may include one or more passages enclosed in <p> tags.

Format: vocab.all

```
utf8
Copper
version
EGCG
432Kbps
RESERVECHARDONNAY
```

- This file contains all vocabularies in NTCIR documents.
- The **first line** is character **encoding format**.
- Each line of the following is a vocabulary.
- Vocabularies are case-sensitive.
- Each vocabulary will have a ***vocab_id*** according to its **line number**.
    - E.g., the *vocab_id* of "Copper" is 1; "version" is 2

Format: file-list

```
CIRB010/cdn/loc/CDN_LOC_0001457
CIRB010/cdn/loc/CDN_LOC_0000294
CIRB010/cdn/loc/CDN_LOC_0000120
CIRB010/cdn/loc/CDN_LOC_0000661
CIRB010/cdn/loc/CDN_LOC_0001347
CIRB010/cdn/loc/CDN_LOC_0000439
```

- This is a list of all NTCIR documents.
- Each line denotes a document which has its **zero-indexed line number** (start from 0) as its ***file_id***.
  - E.g.
  - ./CIRB010/cdn/loc/CDN_LOC_0001457 has *file_id* 0,
  - ./CIRB010/cdn/loc/CDN_LOC_0000294 has *file_id* 1.

Format: inverted-file

```
1 -1 2
33689 1
38365 1
2 -1 1
33256 1
2 12371 1
33256 1
```

- *vocab_id* and *file_id* referred from *vocab.all* and *file-list*.
- ***vocab_id_1 vocab_id_2*** denotes an **unigram** when *vocab_id_2*==-1 or a **bigram** when *vocab_id_2*!=-1.
- If there are **N files** containing *vocab_id_1 vocab_id_2*,
  there will be the number **N** next to vocab_id_2,
  followed by **N lines** that display the counts of this term in each file
  - *vocab_id_1 vocab_id_2* N
  - *file_id* count ... (N lines)

Program IO

- Your program is required to support input of a **query file**,
  and output a **ranking list**. (Please see Query File Format and Ranking List Format)
- We provide 30 query topics for you as inputs.
  (only 10 with answers and the others are used to evaluate your performance)
- There is no restriction to the programming language you use (we suggest python),
  but make sure your program is **executable on R217 workstation**.
- Using the third party tools directly for VSM or Relevance Feedback is prohibited.

Query File Format

- The NTCIR topic format conforms to XML 1.0, in which the document is rooted at an <xml> tag.
- The file contains multiple topics, each of them is enclosed in a <topic> tag. In each topic, different types of information are specified by the following tags:
  - <number>: The topic number.
  - <title>: The topic title.
  - <question>: A short description about the query topic.
  - <narrative>: Even more verbose descriptions about the topic.
  - <concepts>: A set of keywords that can be used in retrieval about the topic.
- You have to retrieve several relevant documents for each topic.
- All the content of title, question, narrative, and concepts can be used as the query of the topic, it's your own choice to decide which part(s) you want to use.

Ranking List Format

- The first line includes two column names: *“query_id”*, *“retrieved_docs”*
- First column: ***query_id***, which is **the last three digits** in <number>...<number> tag in the query xml file.
- Second column: ***document_ids***, which is the string in <id>...</id> tag in the NTCIR document. Please note it should be in lowercase.
- The two columns should be separated by a comma.
- Document ids should be separated by spaces.
- Note that retrieved docs should be sorted by their ranks.
- You can retrieve **at most 100 documents** for each topic.

Program Execution Details

- You are given two shell scripts to compile and run your program.
- You should edit these two scripts according to how you implement this assignment.
- When testing your program, we will execute the following commands **on R217 workstation**, please make sure your program is executable on the workstation.
    - $./compile.sh
    - $./execute.sh -option1 value1 -option2 value2...

Program Execution Details (Cont.)

- Here are the required options that must be supported by your program. (Options without default values are guaranteed to be specified when we test your program.)

```
SYNOPSIS:
  execute.sh [-r] -i query-file -o ranked-list -m model-dir -d NTCIR-dir

OPTIONS:
  -r
      If specified, turn on the relevance feedback in your program.
  -i query-file
      The input query file.
  -o ranked-list
      The output ranked list file.
  -m model-dir
      The input model directory, which includes three files:
          model-dir/vocab.all
          model-dir/file-list
          model-dir/inverted-index
  -d NTCIR-dir
      The directory of NTCIR documents, which is the path name of CIRB010 directory.
      ex. If the directory's pathname is /tmp2/CIRB010, it will be "-d /tmp2/CIRB010".
```

Restrictions

- You should generate features like tf-idf, implement **VSM** and **Rocchio Relevance Feedback** by yourself without using any other packages.
- If you are not sure packages you used is legal or not, please inquiry TA on the NTU COOL discussion page.
- Your program should finish in 5 minutes.
- Do not copy other's code. Those who copy code and those who allow others to copy his/her code will be punished seriously.
- Do not copy code generated by Large Language Models

Evaluation

- We will use the **Mean Average Precision (MAP)** value to evaluate your ranking list.
- We provide an answer ranking list for *query-train.xml*.
    - There're two columns in the answer list, first is the *query_id*, followed by *retrieved_docs* relevant to this topic.
    - You can use this answer list to check your system's performance.
- Please produce a ranking list of *query-test.xml* and submit to **Kaggle**. You can see your performance ranking on the leaderboard.

Report

- Please write your report as a report.pdf and put it into the zipped file. The report should contain the following content:
  - Describe your VSM (e.g., parameters....)
  - Describe your Rocchio Relevance Feedback (e.g., how do you define relevant documents, parameters...)
  - **Results of Experiments**
    - **MAP value under different parameters of VSM**
    - **Feedback vs. no Feedback**
    - Other experiments you tried
  - Discussion: what you learn in the homework.

Submission

- Please put report, scripts and code into the directory named your **PA1_{student ID}**. Package this **folder** into a zip file and submit it to NTU COOL, following is the structure and content of the **zip**:
- For example: PA1_R13XXXXXX.zip ((1), (2), ... generated by COOL is allowed)
  - +---PA1_R13XXXXXX (**directory**) (with the student ID's first letter uppercase)
    - +---**README.md** (list how to run your code and the packages needed)
    - +---**report.pdf**
    - +---compile.sh
    - +---execute.sh
    - +---All the other files and **source code** required by your program
  - (Note that you don't need to submit the model files and NTCIR documents)

Scoring (see next page)

- The total score of 100 is worth 20% of your final grade.
  - VSM model implementation (20%)
  - Rocchio relevance feedback implementation (10%)
  - Report (20%)
  - Performance (Note that the private scores will be released after the deadline)
    - ~~Better than **simple** baseline on **public** leaderboard (20%)~~
    - ~~Better than **simple** baseline on **private** leaderboard (5%)~~
    - ~~Better than **strong** baseline on **public** leaderboard (20%)~~
    - ~~Better than **strong** baseline on **private** leaderboard (5%)~~

Scoring (UPDATED)

- The total score of 100 is worth 20% of your final grade.
  - VSM model implementation (20%)
  - Rocchio relevance feedback implementation (10%)
  - Report (20%)
  - Performance (Note that the private scores will be released after the deadline)
    - Better than **simple** baseline on **public** leaderboard (20%)
    - Better than **simple** baseline on **private** leaderboard (5%)
    - Better than **strong** baseline on **public** leaderboard (10%)
    - Better than **strong** baseline on **private** leaderboard (5%)
    - Better than **hard** baseline on **public** leaderboard (5%)
    - Better than **hard** baseline on **private** leaderboard (5%)

Scoring Rules (Important)

- Note that you will **receive 0 points** in the following situations:
  - You didn't sign the user agreement form
  - You don’t have a record on the ranking website (for performance score)
  - We can’t run your code, or the run time limit exceeded (5 min)
  - You plagiarize someone else’s code
  - Your code or report is directly generated by LLMs
- -3 points for the wrong file format or missing files

Competition on kaggle

- This is individual homework.

  One person in each team.

  One account per person.

- The link of the competition is below:

  - https://www.kaggle.com/competitions/wm-2025-vector-space-mode

Bonus

- Extra score for top-6 ranking on public and private leaderboard respectively
- 2% for 1st-3rd
- 1% for 4th-6th
- rank 1 at public, rank 5 at private → 3 points

Leaderboard

- Public/Private leaderboard
- 10/10 queries for public and private respectively
- Best on public ≠ best on private
- Private score will be released after deadline

Rules

- One account per participant only
- The team name on the leaderboard **must** be your **student ID** (with upper case).
- You may select up to 2 final submissions for judging.
- You may submit a maximum of 5 entries per day.
- We encourage discussing with others or asking AI tools, but you need to write your code yourself.

Deadline

- **Kaggle** Deadline: 2025/04/06 23:59:59 (UTC+8)
- **Report** Deadline: 2025/04/07 ~~11:59:59~~ 23:59:59 (UTC+8)
- **User Agreement Form** Deadline: 2025/04/07 ~~11:59:59~~ 23:59:59 (UTC+8)
- Late policy: -10% per day (No late submission for kaggle)
- If you have any questions, ask on the NTU COOL discussion page. We will focus on answering questions there.
- For other personal questions, email to TAs: ir2025.ntu@gmail.com