

Information Retrieval

Advanced Database Systems - Project 1

Team Information

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- **UNIs:** bc2975, mt3634

Submitted Files

- `query_expansion.py` - Main Python script implementing query expansion
- `rocchio.py` - Implementation of the Rocchio Algorithm
- `requirements.txt` - List of required Python libraries
- `README.md` - This documentation file
- `proj1-stop.txt` - List of all of our stop words

API Credentials

- **Google Custom Search API Key:** AIzaSyDSfAcOzN3SyrUDN2fCe_QNIix3sOLN5Rk
- **Google Custom Search Engine ID:** c66d0519df77f44f1

Setup Instructions:

1. Connect to Google Cloud VM:

```
ssh your-username@your-vm-ip
```

2. Install Required Software:

```
sudo apt update
sudo apt install python3-pip
```

3. Clone the Repository:

```
git clone https://github.com/maxinetamas/InformationRetrieval.git
cd InformationRetrieval
```

4. Install Dependencies:

```
pip install -r requirements.txt
```

5. Run the Program:

To run the program, you need to use the Google Custom Search API key and Google Custom Search Engine ID above, as well as provide the desired precision, and the query you want to run.

The format would be something like:

```
python3 query_expansion.py YOUR_GOOGLE_API_KEY YOUR_GOOGLE_ENGINE_ID PRECISION "your search query"
```

And an example would look like:

```
python3 query_expansion.py AIzaSyDSfAcOzN3SyrUDN2fCe_QNIix3sOLN5Rk c66d0519df77f44f1 0.8 "machine learning"
```

Internal Design

The project consists of the following main components:

- **Query Expansion Module:** Implements the Rocchio Algorithm for query refinement.

- **Google Custom Search API Handler:** Handles search queries and fetches results using the Google Custom Search API.
- **Relevance Feedback Processor:** Analyzes the search results and selects relevant keywords based on user feedback.
- **Command-Line Interface:** Provides an interface for running queries and obtaining results.

External Libraries Used

- `requests` - For making API calls to Google Custom Search (Note: While `requests` is commonly used for making API calls, this project uses `google-api-python-client` to interact with the Google Custom Search API.)
- `numpy` - For vector operations in the Rocchio Algorithm
- `json` - For handling API responses and configurations
- `argparse` - For parsing command-line arguments
- `google-api-python-client` - Interacting with the Google Custom Search API
- `scikit-learn` - Using `TfidfVectorizer` for calculating TF-IDF values.

Query Modification Method

The core component of this project is the query expansion process using the Rocchio Algorithm, which follows these steps:

1. Initial Query Execution:

The original query is sent to the Google Custom Search API.

2. Relevance Feedback Collection:

The user marks each of the top-10 results as relevant (Y) or non-relevant (N) via the command line.

3. Vector-Based Query Adjustment:

The Rocchio Algorithm modifies the query vector by:

- Increasing weights of terms from relevant results
- Decreasing weights of terms from non-relevant results

4. Term Reordering and Expansion:

Our enhanced implementation:

- Reorders ALL terms (both original and new) based on their TF-IDF weights
- Places the most discriminative terms first in the query
- Adds up to 2 new high-weight terms not in the original query

5. Iterative Refinement:

Steps 1-4 are repeated until the target precision is reached or the precision no longer improves.

Query Word Order Determination

Our implementation improves upon basic Rocchio by:

- Computing weights for all terms (original query + potential new terms)
- Sorting terms by their weight in descending order
- Creating a new query that maintains this weight-based ordering

This approach leverages the fact that search engines often give more weight to terms that appear earlier in the query.

Program Run Transcripts

Below is a sample transcript of the program's execution:

```
Parameters:
Client key = AIzaSyDSfAcOzN3SyrUDN2fCe_QNIIX3sOLN5Rk
Engine key = c66d0519df77f44f1
Query = machine learning
Precision = 0.8
Google Search Results:

Result 1
URL: https://example.com/1
Title: Introduction to Machine Learning
Summary: Machine learning is a subfield of artificial intelligence...
Relevant (Y/N)? Y
[results continued...]
FEEDBACK SUMMARY
Query: machine learning
Precision: 0.6
Still below the desired precision of 0.8
Indexing results...
Indexing results...
Augmenting by deep neural
Parameters:
Client key = YOUR_GOOGLE_API_KEY
Engine key = YOUR_GOOGLE_ENGINE_ID
Query = deep neural machine learning
Precision = 0.8
[second iteration continues...]
...
...
...
Desired precision reached.
```

Per Se Transcript

```
python query_exp.py AIzaSyDSfAcOzN3SyrUDN2fCe_QNIIX3sOLN5Rk c66d0519df77f44f1 0.9 "per se"
```

Parameters:

```
Client key = AIzaSyDSfAcOzN3SyrUDN2fCe_QNIIX3sOLN5Rk
```

```
Engine key = c66d0519df77f44f1
```

```
Query      = per se
```

```
Precision  = 0.9
```

Google Search Results:

=====

Result 1

```
[
  URL: https://www.thomaskeller.com/perseny
  Title: Per Se | Thomas Keller Restaurant Group
  Summary: Per Se. Per Se Front Door. center. Michelin; Les Grandes; Relias. About. About; Restaurant · Team · Info & Directio
]
```

Relevant (Y/N)?y

Result 2

```
[
  URL: https://www.merriam-webster.com/dictionary/perse
  Title: PERSE Definition & Meaning - Merriam-Webster
  Summary: The meaning of PERSE is of a dark grayish blue resembling indigo. How to use perse in a sentence. Did you know?
]
```

Relevant (Y/N)?n

Result 3

```
[
  URL: https://www.thomaskeller.com/new-york-new-york/per-se/todays-menus
  Title: Today's Menus | Thomas Keller Restaurant Group
  Summary: Per Se. Daily Menus. Two tasting menus are offered daily: a nine-course chef's tasting menu, as well as a ... Per S
]
```

Relevant (Y/N)?y

Result 4

```
[
  URL: https://www.reddit.com/r/grammar/comments/otxmm7/how_does_one_use_per_se/
  Title: How does one use 'per se'? : r/grammar
  Summary: Jul 29, 2021 ... Comments Section ... It roughly means "by itself", "in itself" or "of itself" and is often used w
]
```

Relevant (Y/N)?n

Result 5

```
[
  URL: https://en.wikipedia.org/wiki/Per_se
  Title: Per se - Wikipedia
  Summary: a primary topic, and an article needs to be written about it. It is believed to qualify as a broad-concept article
]
```

Relevant (Y/N)?n

Result 6

```
[
  URL: https://www.nytimes.com/2004/09/08/dining/the-magic-of-napa-with-urban-polish.html
  Title: The Magic of Napa With Urban Polish - The New York Times
  Summary: Sep 8, 2004 ... Frank Bruni reviews Per Se, Thomas Keller's restaurant at Time Warner Center; photos (L)
]
```

Relevant (Y/N)?y

Result 7

```
[
  URL: https://www.instagram.com/perseny/?hl=en
  Title: Per Se (@perseny) • Instagram photos and videos
  Summary: 283K Followers, 202 Following, 1020 Posts - Per Se (@perseny) on Instagram: "Chef Thomas Keller's 3-Star Michelin
]
```

Relevant (Y/N)?y

Result 8

```
[
  URL: https://www.jamesperse.com/
  Title: James Perse Los Angeles
  Summary: James Perse. Women. Women; Apparel. Apparel Main Menu; New Arrivals · At Home Essentials · Classics · Dresses/Jump
]
```

Relevant (Y/N)?n

Result 9

```
[
  URL: https://readable.com/blog/how-to-correctly-use-per-se/
  Title: Per se meaning, how to use per se in a sentence | Readable ...
  Summary: Aug 11, 2017 ... 'Per se' is a Latin term which literally means, "by itself", "in itself" or "of itself". This mea
]
Relevant (Y/N)?n
Result 10
[
  URL: https://en.wikipedia.org/wiki/Per_Se_(restaurant)
  Title: Per Se (restaurant) - Wikipedia
  Summary: Per Se (restaurant) ... Per Se is a New American and French restaurant at The Shops at Columbus Circle, on the four
]
Relevant (Y/N)?y

FEEDBACK SUMMARY
Query: per se
Precision: 0.5
Still below the desired precision of 0.9
Indexing results...
Indexing results...
Augmenting by restaurant

Parameters:
  Client key   = AIzaSyDSfAcOzN3SyrUDN2fCe_QNIIX3sOLN5Rk
  Engine key   = c66d0519df77f44f1
  Query        = per se restaurant
  Precision    = 0.9
Google Search Results:
=====
Result 1
[
  URL: https://www.thomaskeller.com/perseny
  Title: Per Se | Thomas Keller Restaurant Group
  Summary: Private Dining & Events · Per Se. Per Se Front Door. center. Michelin; Les Grandes; Relias. About. About; Restaura
]
Relevant (Y/N)?y
Result 2
[
  URL: https://en.wikipedia.org/wiki/Per_Se_(restaurant)
  Title: Per Se (restaurant) - Wikipedia
  Summary: Per Se (restaurant) ... Per Se is a New American and French restaurant at The Shops at Columbus Circle, on the four
]
Relevant (Y/N)?y
Result 3
[
  URL: https://www.thomaskeller.com/new-york-new-york/per-se/todays-menus
  Title: Today's Menus | Thomas Keller Restaurant Group
  Summary: Private Dining & Events · Per Se. Daily Menus. Two tasting menus are offered daily: a nine-course chef's tasting me
]
Relevant (Y/N)?y
Result 4
[
  URL: https://guide.michelin.com/us/en/new-york-state/new-york/restaurant/per-se
  Title: Per Se - New York - a MICHELIN Guide Restaurant
  Summary: Per Se - a Three Stars: Exceptional cuisine restaurant in the 2024 MICHELIN Guide USA. The MICHELIN inspectors' po
]
Relevant (Y/N)?y
Result 5
[
  URL: https://www.thomaskeller.com/new-york-new-york/per-se/restaurant
  Title: Opened in 2004, Per Se is Thomas Keller's acclaimed New York ...
  Summary: Restaurant. Opened in 2004, Per Se is Thomas Keller's acclaimed New York interpretation of The French Laundry in th
]
Relevant (Y/N)?y
Result 6
[
```

```
URL: http://www.kevineats.com/2008/12/per-se-new-york-ny.htm
Title: Per Se (New York, NY) - kevinEats
Summary: Dec 21, 2008 ... Teams from French Laundry were brought over for training, and the restaurant opened on February 14
]
Relevant (Y/N)?y
Result 7
[
URL: https://www.exploretock.com/perse
Title: Per Se - New York, NY | Tock
Summary: Opened in 2004, Per Se is Thomas Keller's acclaimed interpretation of ... restaurant is Chef Keller's second three-
]
Relevant (Y/N)?y
Result 8
[
URL: https://www.instagram.com/perseny/?hl=en
Title: Per Se (@perseny) • Instagram photos and videos
Summary: Chef Thomas Keller's 3-Star Michelin restaurant overlooking Columbus Circle & Central Park located in New York City
]
Relevant (Y/N)?y
Result 9
[
URL: https://www.nytimes.com/2004/09/08/dining/the-magic-of-napa-with-urban-polish.html
Title: The Magic of Napa With Urban Polish - The New York Times
Summary: Sep 8, 2004 ... Yes, yes: Per Se suffers somewhat by comparison with the French Laundry. That is the Napa Valley re
]
Relevant (Y/N)?n
Result 10
[
URL: https://www.thelotimes.com/p/per-se-french-laundry-price-hike-thomas-keller
Title: Per Se's Longest Tasting Is Now $1,000! - by ryan sutton
Summary: Jan 6, 2025 ... Per Se also offers a five-course salon tasting in a separate room with couch seating and low tables
]
Relevant (Y/N)?y
Desired precision reached.
```

Wokcicki Transcript

```
python query_exp.py AIzaSyDSfAcOzN3SyrUDN2fCe_QNIIX3sOLN5Rk c66d0519df77f44f1 0.9 "wojcicki"
```

Parameters:

```
Client key = AIzaSyDSfAcOzN3SyrUDN2fCe_QNIIX3sOLN5Rk
```

```
Engine key = c66d0519df77f44f1
```

```
Query      = wojcicki
```

```
Precision  = 0.9
```

Google Search Results:

=====

Result 1

```
[
  URL: https://en.wikipedia.org/wiki/Susan_Wojcicki
  Title: Susan Wojcicki - Wikipedia
  Summary: an American business executive who was the chief executive officer of YouTube from 2014 to 2023. Her net worth was
]
```

Relevant (Y/N)?n

Result 2

```
[
  URL: https://www.reddit.com/r/poland/comments/3bihro/susan_wojcicki_youtube_ceo_teaches_how_to/
  Title: Susan Wojcicki (YouTube CEO) teaches how to pronounce her ...
  Summary: Jun 29, 2015 ... She's combining Polish and English pronunciation of her last name. She combines the "j" and "c" in
]
```

Relevant (Y/N)?n

Result 3

```
[
  URL: https://x.com/susanwojcicki?lang=en
  Title: Susan Wojcicki (@SusanWojcicki) / X
  Summary: Susan Wojcicki's posts ... 's team and innovative solutions in sustainability and security to enable transparency a
]
```

Relevant (Y/N)?n

Result 4

```
[
  URL: https://www.instagram.com/susanwojcicki/?hl=en
  Title: Susan Wojcicki (@susanwojcicki) • Instagram photos and videos
  Summary: YouTube CEO · Photo shared by YouTube for Families on May 27, 2022 tagging @susanwojcicki. Say hello to @susanwojc
]
```

Relevant (Y/N)?n

Result 5

```
[
  URL: https://x.com/annewoj23?lang=en
  Title: Anne Wojcicki (@annewoj23) / X
  Summary: CEO and Co-Founder, 23andMe.
]
```

Relevant (Y/N)?y

Result 6

```
[
  URL: https://blog.youtube/inside-youtube/a-personal-update-from-susan/
  Title: A personal update from Susan - YouTube Blog
  Summary: A personal update from Susan. By Susan Wojcicki. Feb 16, 2023 - 3 minute read. Copy link. A personal update from S
]
```

Relevant (Y/N)?y

Result 7

```
[
  URL: https://www.instagram.com/heywoj/?hl=en
  Title: Esther Wojcicki (@heywoj) • Instagram photos and videos
  Summary: 8216 Followers, 1802 Following, 2042 Posts - Esther Wojcicki (@heywoj) on Instagram: " Author of How to Raise Succ
]
```

Relevant (Y/N)?n

Result 8

```
[
  URL: https://www.facebook.com/esther.wojcicki/posts/it-is-with-soul-crushing-grief-that-i-announce-the-passing-of-my-daughte
  Title: Esther Wojcicki - It is with soul crushing grief that I... | Facebook
  Summary: Aug 10, 2024 ... It is with soul crushing grief that I announce the passing of my daughter Susan. I am eternally g
]
```

Relevant (Y/N)?n

Result 9

```
[
  URL: https://www.linkedin.com/in/ed-wojcicki-bb02abb
  Title: Ed Wojcicki - Retired... but Consulting and Writing - Retired | LinkedIn
  Summary: Steven Berry. "Ed Wojcicki is a keen listener and intelligent articulator of current circumstances and situations.
]
Relevant (Y/N)?n
Result 10
[
  URL: https://physics.stanford.edu/news/professor-stanley-wojcicki-has-died-age-86
  Title: Professor Stanley Wojcicki has died at age 86 | Physics Department
  Summary: Jun 5, 2023 ... Stanley G. Wojcicki died on May 31, 2023, at his condo in Los Altos at age 86. He still maintained
]
Relevant (Y/N)?n

FEEDBACK SUMMARY
Query: wojcicki
Precision: 0.2
Still below the desired precision of 0.9
Indexing results...
Indexing results...
Augmenting by 23andme

Parameters:
Client key = AIzaSyDSfAcOzN3SyrUDN2fCe_QNIIX3sOLN5Rk
Engine key = c66d0519df77f44f1
Query = wojcicki 23andme
Precision = 0.9
Google Search Results:
=====
Result 1
[
  URL: https://en.wikipedia.org/wiki/Anne_Wojcicki
  Title: Anne Wojcicki - Wikipedia
  Summary: Anne E. Wojcicki is an American entrepreneur who co-founded and is CEO of the personal genomics company 23andMe. S
]
Relevant (Y/N)?y
Result 2
[
  URL: https://investors.23andme.com/management/anne-wojcicki
  Title: Anne Wojcicki | Board Member, Management | 23andMe, Inc.
  Summary: Anne Wojcicki ... Anne co-founded 23andMe in 2006, three years after the first human genome was sequenced. Her goal
]
Relevant (Y/N)?y
Result 3
[
  URL: https://www.instagram.com/annevoj23/?hl=en
  Title: Anne Wojcicki (@annevoj23) • Instagram photos and videos
  Summary: 15K Followers, 238 Following, 83 Posts - Anne Wojcicki (@annevoj23) on Instagram: "@23andme CEO Co-Founder | Think
]
Relevant (Y/N)?y
Result 4
[
  URL: https://www.linkedin.com/in/annevoj23
  Title: Anne Wojcicki - 23andMe | LinkedIn
  Summary: Experience: 23andMe • Location: Mountain View • 500+ connections on LinkedIn. View Anne Wojcicki's profile on Link
]
Relevant (Y/N)?y
Result 5
[
  URL: https://x.com/annevoj23?lang=en
  Title: Anne Wojcicki (@annevoj23) / X
  Summary: CEO and Co-Founder, 23andMe.
]
Relevant (Y/N)?y
Result 6
[
```



```
URL: https://www.cbsnews.com/news/23andme-ceo-anne-wojcicki/
Title: 23andMe CEO Anne Wojcicki responds to critics, shares plan for ...
Summary: Nov 27, 2024 ... Wojcicki said she's confident that in 2025, the company will be "growing and thriving." In five years
]
Relevant (Y/N)?y
Result 7
[
URL: https://articles.sequoiacap.com/2018-12-12-anne-wojcicki
Title: Seven Questions with Anne Wojcicki
Summary: Dec 12, 2018 ... Anne Wojcicki is co-founder and CEO of 23andMe, a direct-to-consumer genetic testing company with
]
Relevant (Y/N)?y
Result 8
[
URL: https://blog.23andme.com/tag/anne-wojcicki
Title: Anne Wojcicki Archives - 23andMe Blog
Summary: Anne Wojcicki, 23andMe's CEO, co-founded the company in 2006, three years after the first human genome was sequenced
]
Relevant (Y/N)?y
Result 9
[
URL: https://www.23andme.com/about/
Title: About us - 23andMe
Summary: We're not just a health company; we're not just ancestry; we're all of these things. We want to tell you about you
]
Relevant (Y/N)?y
Result 10
[
URL: https://fortune.com/2024/10/17/23andme-what-happened-stock-board-resigns-anne-wojcicki/
Title: DNA tester 23andMe's entire board resigned on the same day ...
Summary: Oct 17, 2024 ... As for Wojcicki, 23andMe has garnered takeover interest from a small New York-based DNA testing startup
]
Relevant (Y/N)?y
Desired precision reached.
```

Milky Way Transcript

```
(venv-ml) MacBook-Pro-671:InformationRetrieval maxinetamas$ python query_exp.py AIzaSyDSfAcOzN3SyrUDN2fCe_QNIIX3sOLN5Rk c66d0519df77f44f1

Parameters:

    Client key  = AIzaSyDSfAcOzN3SyrUDN2fCe_QNIIX3sOLN5Rk
    Engine key  = c66d0519df77f44f1
    Query       = milky way
    Precision   = 0.9

Google Search Results:
=====

Result 1

    [
      URL: https://en.wikipedia.org/wiki/Milky_Way
      Title: Milky Way - Wikipedia
      Summary: The Milky Way is a barred spiral galaxy with a D25 isophotal diameter estimated at  $26.8 \pm 1.1$  kiloparsecs (87,400 light years) in diameter. It is a member of the Local Group, a collection of more than 50 galaxies that are gravitationally bound together. The Milky Way is a barred spiral galaxy, meaning it has a central bar-shaped structure from which spiral arms emerge. The bar is composed of stars and gas, and the spiral arms are also composed of stars and gas. The Milky Way is a member of the Local Group, a collection of more than 50 galaxies that are gravitationally bound together. The Milky Way is a member of the Local Group, a collection of more than 50 galaxies that are gravitationally bound together.
    ]

Relevant (Y/N)?n

Result 2

    [
      URL: https://www.milkywaybar.com/
      Title: Explore MILKY WAY® Official Website | Chocolate Bars
      Summary: Explore MILKY WAY® Bar products and nutrition information, fun facts about the oh so stretchy caramel chocolate bars, and more.
    ]

Relevant (Y/N)?y

Result 3

    [
      URL: https://www.milkywayla.com/
      Title: Milky Way LA Restaurant Los Angeles
      Summary: Opened in 1977 by Bernie & Leah (Spielberg) Adler, The Milky Way is a storied, family-owned restaurant located in Los Angeles. The restaurant is known for its classic American cuisine, including burgers, fries, and milkshakes. The Milky Way is a storied, family-owned restaurant located in Los Angeles. The restaurant is known for its classic American cuisine, including burgers, fries, and milkshakes. The Milky Way is a storied, family-owned restaurant located in Los Angeles. The restaurant is known for its classic American cuisine, including burgers, fries, and milkshakes.
    ]

Relevant (Y/N)?n

Result 4

    [
      URL: https://science.nasa.gov/resource/the-milky-way-galaxy/
      Title: The Milky Way Galaxy - NASA Science
      Summary: Nov 8, 2017 ... The Milky Way's elegant spiral structure is dominated by just two arms wrapping off the ends of a central bar. The Milky Way is a barred spiral galaxy, meaning it has a central bar-shaped structure from which spiral arms emerge. The bar is composed of stars and gas, and the spiral arms are also composed of stars and gas. The Milky Way is a member of the Local Group, a collection of more than 50 galaxies that are gravitationally bound together.
    ]

Relevant (Y/N)?n

Result 5

    [
      URL: https://www.space.com/19915-milky-way-galaxy.html
      Title: Milky Way galaxy: Facts about our cosmic neighborhood | Space
      Summary: Apr 18, 2023 ... Everything else in the galaxy revolves around this powerful gateway to nothingness. In its immediate vicinity, the Milky Way is a barred spiral galaxy, meaning it has a central bar-shaped structure from which spiral arms emerge. The bar is composed of stars and gas, and the spiral arms are also composed of stars and gas. The Milky Way is a member of the Local Group, a collection of more than 50 galaxies that are gravitationally bound together.
    ]

Relevant (Y/N)?n

Result 6

    [
      URL: https://imagine.gsfc.nasa.gov/science/objects/milkyway1.html
      Title: NASA - The Milky Way Galaxy
      Summary: The Milky Way is a large barred spiral galaxy. All the stars we see in the night sky are in our own Milky Way Galaxy. The Milky Way is a barred spiral galaxy, meaning it has a central bar-shaped structure from which spiral arms emerge. The bar is composed of stars and gas, and the spiral arms are also composed of stars and gas. The Milky Way is a member of the Local Group, a collection of more than 50 galaxies that are gravitationally bound together.
    ]

Relevant (Y/N)?n

Result 7

    [
      URL: https://www.amnh.org/explore/ology/astronomy/the-milky-way-galaxy2
      Title: The Milky Way Galaxy | AMNH
      Summary: The Milky Way is a huge collection of stars, dust and gas. It's called a spiral galaxy because if you could view it from the side, it would look like a pinwheel. The Milky Way is a barred spiral galaxy, meaning it has a central bar-shaped structure from which spiral arms emerge. The bar is composed of stars and gas, and the spiral arms are also composed of stars and gas. The Milky Way is a member of the Local Group, a collection of more than 50 galaxies that are gravitationally bound together.
    ]

Relevant (Y/N)?n

Result 8

    [
      URL: https://www.milkywaypgh.com/
      Title: Milky Way Pittsburgh
      Summary: Here at Milky Way, we pride ourselves on offering delicious Kosher alternatives to the essential pizzeria foods no one can resist. The Milky Way is a barred spiral galaxy, meaning it has a central bar-shaped structure from which spiral arms emerge. The bar is composed of stars and gas, and the spiral arms are also composed of stars and gas. The Milky Way is a member of the Local Group, a collection of more than 50 galaxies that are gravitationally bound together.
    ]

Relevant (Y/N)?n

Result 9
```



```
(venv-ml) MacBook-Pro-671:InformationRetrieval maxinetamas$ python query_exp.py AIzaSyDSfAcOzN3SyrUDN2fCe_QNIIX3sOLN5Rk c66d0519df777
Parameters:
  Client key  = AIzaSyDSfAcOzN3SyrUDN2fCe_QNIIX3sOLN5Rk
  Engine key  = c66d0519df777f44f1
  Query       = milky way
  Precision   = 0.9
Google Search Results:
=====
Result 1
  [
    URL: https://en.wikipedia.org/wiki/Milky_Way
    Title: Milky Way - Wikipedia
    Summary: The Milky Way is a barred spiral galaxy with a D25 isophotal diameter estimated at  $26.8 \pm 1.1$  kiloparsecs (87,400 ...
  ]
Relevant (Y/N)?n
Result 2
  [
    URL: https://www.milkywaybar.com/
    Title: Explore MILKY WAY® Official Website | Chocolate Bars
    Summary: Explore MILKY WAY® Bar products and nutrition information, fun facts about the oh so stretchy caramel chocolate ba
  ]
Relevant (Y/N)?y
Result 3
  [
    URL: https://www.milkywayla.com/
    Title: Milky Way LA Restaurant Los Angeles
    Summary: Opened in 1977 by Bernie & Leah (Spielberg) Adler, The Milky Way is a storied, family-owned restaurant located in t
  ]
Relevant (Y/N)?n
Result 4
  [
    URL: https://science.nasa.gov/resource/the-milky-way-galaxy/
    Title: The Milky Way Galaxy - NASA Science
    Summary: Nov 8, 2017 ... The Milky Way's elegant spiral structure is dominated by just two arms wrapping off the ends of a c
  ]
Relevant (Y/N)?n
Result 5
  [
    URL: https://www.space.com/19915-milky-way-galaxy.html
    Title: Milky Way galaxy: Facts about our cosmic neighborhood | Space
    Summary: Apr 18, 2023 ... Everything else in the galaxy revolves around this powerful gateway to nothingness. In its immedi
  ]
Relevant (Y/N)?n
Result 6
  [
    URL: https://imagine.gsfc.nasa.gov/science/objects/milkyway1.html
    Title: NASA - The Milky Way Galaxy
    Summary: The Milky Way is a large barred spiral galaxy. All the stars we see in the night sky are in our own Milky Way Gala
  ]
Relevant (Y/N)?n
Result 7
  [
    URL: https://www.amnh.org/explore/ology/astronomy/the-milky-way-galaxy2
    Title: The Milky Way Galaxy | AMNH
    Summary: The Milky Way is a huge collection of stars, dust and gas. It's called a spiral galaxy because if you could view it
  ]
Relevant (Y/N)?n
Result 8
  [
    URL: https://www.milkywaypgh.com/
    Title: Milky Way Pittsburgh
    Summary: Here at Milky Way, we pride ourselves on offering delicious Kosher alternatives to the essential pizzeria foods no
  ]
Relevant (Y/N)?n
Result 9
```

```
[
  URL: https://www.nasa.gov/image-article/milky-way-on-the-horizon/
  Title: Milky Way on the Horizon - NASA
  Summary: 21 hours ago ... NASA astronaut Don Pettit used a camera with low light and long duration settings to capture this
]
Relevant (Y/N)?n
Result 10
[
  URL: https://rowstercoffee.com/products/milky-way
  Title: Milky Way - Rowster Coffee
  Summary: Roast Level: Medium - Dark Tasting Notes: Rich, Walnut, Sweet Description: Our flagship blend, showcases our range
]
Relevant (Y/N)?n

FEEDBACK SUMMARY
Query: milky way
Precision: 0.1
Still below the desired precision of 0.9
Indexing results...
Indexing results...
Augmenting by bar

Parameters:
  Client key = AIzaSyDSfAcOzN3SyrUDN2fCe_QNIix3sOLN5Rk
  Engine key = c66d0519df77f44f1
  Query      = milky way bar
  Precision  = 0.9
Google Search Results:
=====
Result 1
[
  URL: https://en.wikipedia.org/wiki/Milky_Way_(chocolate_bar)
  Title: Milky Way (chocolate bar) - Wikipedia
  Summary: Milky Way (chocolate bar) ... Milky Way is a brand of chocolate-covered confectionery bar manufactured and marketed
]
Relevant (Y/N)?y
Result 2
[
  URL: https://www.milkywaybar.com/
  Title: Explore MILKY WAY® Official Website | Chocolate Bars
  Summary: Explore MILKY WAY® Bar products and nutrition information, fun facts about the oh so stretchy caramel chocolate bar
]
Relevant (Y/N)?y
Result 3
[
  URL: https://www.milkywaycocktails.com/
  Title: Milky Way
  Summary: C'est une fraicheur tropicale qui vous attend en haut des marches black light et fluo du Milky Way. Niché au coeur
]
Relevant (Y/N)?n
Result 4
[
  URL: https://www.reddit.com/r/AskEurope/comments/9plczy/whats_inside_a_milky_way_bar/
  Title: What's inside a Milky Way bar? : r/AskEurope
  Summary: Oct 19, 2018 ... I was surprised when I watched this ad because in Russia Milky Way contains souffle inside.
]
Relevant (Y/N)?y
Result 5
[
  URL: https://greenvalleykitchen.com/milky-way-walnut-cookie-bars/
  Title: Milky Way Walnut Cookie Bars - Green Valley Kitchen
  Summary: Nov 16, 2014 ... I added 1 cup of Milky Way pieces to the batter. After baking the cookie bars for 15 minutes, I t
]
Relevant (Y/N)?n
Result 6
[
```

```
URL: https://www.reddit.com/r/cocktails/comments/b72cub/almost_3_months_after_the_opening_milky_way/
Title: Almost 3 months after the opening ! Milky Way cocktail bar in MTL : r ...
Summary: Mar 29, 2019 ... The bar looks AWESOME! I'm in the process of opening a spot in Chicago and we're currently in the
]
Relevant (Y/N)?n
Result 7
[
URL: https://www.tripadvisor.com/ShowTopic-g60709-i381-kl0932518-Milky_Way-Bar_Harbor_Mount_Desert_Island_Maine.html
Title: Milky Way - Bar Harbor Forum - Tripadvisor
Summary: Oct 12, 2017 ... Yes, you should be able to see the Milky Way on a clear night in Acadia at this time of year. Ear
]
Relevant (Y/N)?n
Result 8
[
URL: https://www.reddit.com/r/candy/comments/1ekb7gy/is_there_a_real_difference_between_a_mars_bar_and/
Title: Is there a real difference between a Mars Bar and a Milky Way? : r ...
Summary: Aug 5, 2024 ... The US Milky Way is softer in texture than a Mars bar. Third, the ratio of nougat, caramel and cho
]
Relevant (Y/N)?y
Result 9
[
URL: https://www.aanda.org/articles/aa/full_html/2024/01/aa48365-23/aa48365-23.html
Title: Insights from super-metal-rich stars: Is the Milky Way bar young ...
Summary: Jan 10, 2024 ... We study a homogeneous and large sample of SMR stars in the SND to provide tighter constraints on
]
Relevant (Y/N)?n
Result 10
[
URL: https://www.reddit.com/r/todayilearned/comments/17f88kl/til_the_chocolate_bar_milky_way_is_called_mars/
Title: TIL The chocolate bar Milky Way is called Mars Bar by the non-US ...
Summary: Oct 24, 2023 ... Aus - Milky way is a tiny bar with just whipped nougat. A Mars bar is full size with a layer of c
]
Relevant (Y/N)?y

FEEDBACK SUMMARY
Query: milky way bar
Precision: 0.5
Still below the desired precision of 0.9
Indexing results...
Indexing results...
Augmenting by chocolate

Parameters:
Client key = AIzaSyDSfAcOzN3SyrUDN2fCe_QNIIX3sOLN5Rk
Engine key = c66d0519df77f44f1
Query = bar way milky chocolate
Precision = 0.9
Google Search Results:
=====
Result 1
[
URL: https://en.wikipedia.org/wiki/Milky_Way_(chocolate_bar)
Title: Milky Way (chocolate bar) - Wikipedia
Summary: Milky Way (chocolate bar) ... Milky Way is a brand of chocolate-covered confectionery bar manufactured and markete
]
Relevant (Y/N)?y
Result 2
[
URL: https://www.milkywaybar.com/
Title: Explore MILKY WAY® Official Website | Chocolate Bars
Summary: Explore MILKY WAY® Bar products and nutrition information, fun facts about the oh so stretchy caramel chocolate bar
]
Relevant (Y/N)?y
Result 3
[
URL: https://sherisilver.com/2016/06/23/white-chocolate-milky-way-bars/
```

Title: white chocolate milky way bars! | Sheri Silver - living a well-tended ...

Summary: Jun 23, 2016 ... 2 cups white chocolate chips, divided 7-ounce container Marshmallow Fluff 1/4 cup malted milk powder

Relevant (Y/N)?y

Result 4

[

URL: <https://www.milkywaybar.com/our-products>

Title: Our Chocolate Candy Bar Products | MILKY WAY®

Summary: So. Much. Caramel. From classic favorites to latest releases, discover every MILKY WAY®chocolate candy product.

]

Relevant (Y/N)?y

Result 5

[

URL: <https://www.amazon.com/MilkyWay-Candy-Milk-Chocolate-Bars/dp/B0029JFOVK>

Title: MilkyWay Candy Milk Chocolate Bars Bulk Pack, Full ... - Amazon.com

Summary: MilkyWay Candy Milk Chocolate Bars Bulk Pack, Full Size, 1.84 oz Pack of 36) · 1.84 Ounce (Pack of 36). \$38.94\$38.94

]

Relevant (Y/N)?y

Result 6

[

URL: https://www.reddit.com/r/unpopularopinion/comments/qhxa8h/milky_way_is_the_best_chocolate_bar/

Title: Milky Way is the best chocolate bar. : r/unpopularopinion

Summary: Oct 28, 2021 ... Milky Way is the best chocolate bar. Call me a child, but the smoothness of the milk chocolate, and

]

Relevant (Y/N)?y

Result 7

[

URL: <https://www.cupcakeproject.com/nougat-with-chocolate-malt-like-in/>

Title: Nougat With Chocolate Malt - Like in Milky Way Bars - Cupcake ...

Summary: Jan 24, 2011 ... Ingredients · 2 cups granulated sugar · 2/3 cup light corn syrup · 2/3 cup water · 2 large eggs

]

Relevant (Y/N)?y

Result 8

[

URL: https://www.reddit.com/r/traderjoes/comments/13v42j9/appreciation_post_for_the_scoring_on_the_milk/

Title: Appreciation post for the scoring on the milk chocolate and ...

Summary: May 29, 2023 ... Is it just me or does the branding on the packaging make anyone else think of the Milk Bar corn fudge?

]

Relevant (Y/N)?n

Result 9

[

URL: <https://chocolatebythebay.com/magazine/outsidechocolate/the-milky-way/>

Title: The Milky Way - Chocolate by the Bay

Summary: Feb 17, 2022 ... The taste was unique: savory, not very milky, a little smoky, and caramelized. It's a not too sweet

]

Relevant (Y/N)?y

Result 10

[

URL: <https://togo.foodlion.com/store/food-lion/products/103823-milky-way-milk-chocolate-candy-bar-share-2-ea>

Title: Milky Way Candy Milk Chocolate Bar Share Size Same-Day ...

Summary: Smooth nougat, creamy caramel and rich milk chocolate. That's what some might call the MILKY WAY trifecta. And a touch

]

Relevant (Y/N)?y

Desired precision reached.