

```
In [1]: !pip install cohere
        !pip install weaviate-client
```

Collecting cohere

Downloading cohere-4.36-py3-none-any.whl (48 kB)

48.9/48.9 kB 1.5 MB/s eta 0:00

Requirement already satisfied: aiohttp<4.0,>=3.0 in /usr/local/lib/python3.10/dist-packages (from cohere) (3.8.6)

Collecting backoff<3.0,>=2.0 (from cohere)

Downloading backoff-2.2.1-py3-none-any.whl (15 kB)

Collecting fastavro==1.8.2 (from cohere)

Downloading fastavro-1.8.2-cp310-cp310-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (2.7 MB)

2.7/2.7 MB 48.1 MB/s eta 0:00

Requirement already satisfied: importlib_metadata<7.0,>=6.0 in /usr/local/lib/python3.10/dist-packages (from cohere) (6.8.0)

Requirement already satisfied: requests<3.0.0,>=2.25.0 in /usr/local/lib/python3.10/dist-packages (from cohere) (2.31.0)

Requirement already satisfied: urllib3<3,>=1.26 in /usr/local/lib/python3.10/dist-packages (from cohere) (2.0.7)

Requirement already satisfied: attrs>=17.3.0 in /usr/local/lib/python3.10/dist-packages (from aiohttp<4.0,>=3.0->cohere) (23.1.0)

Requirement already satisfied: charset-normalizer<4.0,>=2.0 in /usr/local/lib/python3.10/dist-packages (from aiohttp<4.0,>=3.0->cohere) (3.3.2)

Requirement already satisfied: multidict<7.0,>=4.5 in /usr/local/lib/python3.10/dist-packages (from aiohttp<4.0,>=3.0->cohere) (6.0.4)

Requirement already satisfied: async-timeout<5.0,>=4.0.0a3 in /usr/local/lib/python3.10/dist-packages (from aiohttp<4.0,>=3.0->cohere) (4.0.3)

Requirement already satisfied: yarl<2.0,>=1.0 in /usr/local/lib/python3.10/dist-packages (from aiohttp<4.0,>=3.0->cohere) (1.9.2)

Requirement already satisfied: frozenlist>=1.1.1 in /usr/local/lib/python3.10/dist-packages (from aiohttp<4.0,>=3.0->cohere) (1.4.0)

Requirement already satisfied: aiosignal>=1.1.2 in /usr/local/lib/python3.10/dist-packages (from aiohttp<4.0,>=3.0->cohere) (1.3.1)

Requirement already satisfied: zipp>=0.5 in /usr/local/lib/python3.10/dist-packages (from importlib_metadata<7.0,>=6.0->cohere) (3.17.0)

Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.10/dist-packages (from requests<3.0.0,>=2.25.0->cohere) (3.4)

Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.10/dist-packages (from requests<3.0.0,>=2.25.0->cohere) (2023.7.22)

Installing collected packages: fastavro, backoff, cohere

ERROR: pip's dependency resolver does not currently take into account all the packages that are installed. This behaviour is the source of the following dependency conflicts.

llmx 0.0.15a0 requires openai, which is not installed.

llmx 0.0.15a0 requires tiktoken, which is not installed.

Successfully installed backoff-2.2.1 cohere-4.36 fastavro-1.8.2

Collecting weaviate-client

Downloading weaviate_client-3.25.3-py3-none-any.whl (120 kB)

120.3/120.3 kB 2.0 MB/s eta 0

```

:00:00
Requirement already satisfied: requests<3.0.0,>=2.30.0 in /usr/local/lib/python3.10/dist-packages (from weaviate-client) (2.31.0)
Collecting validators<1.0.0,>=0.21.2 (from weaviate-client)
  Downloading validators-0.22.0-py3-none-any.whl (26 kB)
Collecting authlib<2.0.0,>=1.2.1 (from weaviate-client)
  Downloading Authlib-1.2.1-py2.py3-none-any.whl (215 kB)
_____ 215.3/215.3 kB 17.2 MB/s eta
0:00:00
Requirement already satisfied: cryptography>=3.2 in /usr/local/lib/python3.10/dist-packages (from authlib<2.0.0,>=1.2.1->weaviate-client) (41.0.5)
Requirement already satisfied: charset-normalizer<4,>=2 in /usr/local/lib/python3.10/dist-packages (from requests<3.0.0,>=2.30.0->weaviate-client) (3.3.2)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.10/dist-packages (from requests<3.0.0,>=2.30.0->weaviate-client) (3.4)
Requirement already satisfied: urllib3<3,>=1.21.1 in /usr/local/lib/python3.10/dist-packages (from requests<3.0.0,>=2.30.0->weaviate-client) (2.0.7)
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.10/dist-packages (from requests<3.0.0,>=2.30.0->weaviate-client) (2023.7.22)
Requirement already satisfied: cffi>=1.12 in /usr/local/lib/python3.10/dist-packages (from cryptography>=3.2->authlib<2.0.0,>=1.2.1->weaviate-client) (1.16.0)
Requirement already satisfied: pycparser in /usr/local/lib/python3.10/dist-packages (from cffi>=1.12->cryptography>=3.2->authlib<2.0.0,>=1.2.1->weaviate-client) (2.21)
Installing collected packages: validators, authlib, weaviate-client
Successfully installed authlib-1.2.1 validators-0.22.0 weaviate-client-3.25.3

```

```
In [2]: ! pip install python-dotenv
```

```

Collecting python-dotenv
  Downloading python_dotenv-1.0.0-py3-none-any.whl (19 kB)
Installing collected packages: python-dotenv
Successfully installed python-dotenv-1.0.0

```

SET UP

```
In [3]: import os
# from dotenv import load_dotenv, find_dotenv
# _ = load_dotenv(find_dotenv())
os.environ['OPENAI_API_KEY'] = 'sk-uZyVrTyI4Y6AsQk7d6QET3BlbkFJN1l2hN4WecLHbCV'
```

```
In [4]: import os
import cohere
# Set the API key as an environment variable
os.environ['COHERE_API_KEY'] = '3lnU9wcQk2snFCUPIKF7iI78FIjaipgVEzAJXPPK'

# Now you can use it to instantiate the Cohere client
co = cohere.Client(api_key=os.environ['COHERE_API_KEY'])
```

Let's start by importing Weaviate to access the Wikipedia database.

```
In [5]: import os
import weaviate

# Set the API key as an environment variable
os.environ['WEAVIATE_API_KEY'] = '76320a90-53d8-42bc-b41d-678647c6672e' # OR

# Now you can use it to instantiate the auth configuration
auth_config = weaviate.auth.AuthApiKey(api_key=os.environ['WEAVIATE_API_KEY'])

In [6]: os.environ['WEAVIATE_API_URL'] = "https://cohere-demo.weaviate.network/" # COHERE_API_URL
client = weaviate.Client(
    url=os.environ['WEAVIATE_API_URL'],
    auth_client_secret=auth_config,
    additional_headers={
        "X-Cohere-API-Key": os.environ['COHERE_API_KEY'],
    }
)
```

utils.py file content

The followings are utils.py files so , if you do in VS code store it in utils.py and import it using "from utils import dense_retrieval". AS Using colab writing in same files

```
In [7]: def dense_retrieval(query,
                        client,
                        results_lang='en',
                        properties = ["text", "title", "url", "views", "lang", "_id"],
                        num_results=5):

    nearText = {"concepts": [query]}

    # To filter by language
    where_filter = {
        "path": ["lang"],
        "operator": "Equal",
        "valueString": results_lang
    }
    response = (
        client.query
        .get("Articles", properties)
        .with_near_text(nearText)
        .with_where(where_filter)
        .with_limit(num_results)
        .do()
    )

    result = response['data']['Get']['Articles']

    return result
```

```
In [8]: def keyword_search(query,
                        client,
                        results_lang='en',
                        properties = ["text", "title", "url", "views", "lang", "_id"],
                        num_results=3):

    where_filter = {
        "path": ["lang"],
        "operator": "Equal",
        "valueString": results_lang
    }

    response = (
        client.query.get("Articles", properties)
        .with_bm25(
            query=query
        )
        .with_where(where_filter)
        .with_limit(num_results)
        .do()
    )
    result = response['data']['Get']['Articles']
    return result
```

```
In [9]: def print_result(result):
        """ Print results with colorful formatting """
        for i,item in enumerate(result):
            print(f'item {i}')
            for key in item.keys():
                print(f"{key}:{item.get(key)}")
                print()
            print()
```

Dense Retrieval

```
In [10]: query = "What is the capital of China?"
```

```
In [11]: dense_retrieval_results = dense_retrieval(query, client)
```

```
In [12]: print_result(dense_retrieval_results)
```

```
item 0
_additional: {'distance': -146.66586}
```

lang:en

text:China has four of the world's top ten most competitive financial centers (Shanghai, Hong Kong, Beijing, and Shenzhen), more than any other country. China has three of the world's ten largest stock exchanges (Shanghai, Hong Kong and Shenzhen), both by market capitalization and by trade volume. As of 12 October 2020, the total market capitalization of Mainland Chinese stock markets, consisting of the Shanghai Stock Exchange and Shenzhen Stock Exchange, topped US\$10trillion, excluding the Hong Kong Stock Exchange, with about US\$5.9trillion.

title:Economy of China

url:<https://en.wikipedia.org/wiki?curid=19284336>

views:2000

```
item 1
_additional: {'distance': -146.58931}
```

lang:en

text:China had one of the largest economies in the world for most of the past two thousand years, during which it has seen cycles of prosperity and decline. Since economic reforms began in 1978, China has developed into a highly diversified economy and one of the most consequential players in international trade. Major sectors of competitive strength include manufacturing, retail, mining, steel, textiles, automobiles, energy generation, green energy, banking, electronics, telecommunications, real estate, e-commerce, and tourism. China has three out of the ten largest stock exchanges in the world—Shanghai

ai, Hong Kong and Shenzhen—that together have a market capitalization of over \$15.9 trillion, as of October 2020. China has four (Shanghai, Hong Kong, Beijing, and Shenzhen) out of the world's top ten most competitive financial centers, which is more than any country in the 2020 Global Financial Centres Index. By 2035, China's four cities (Shanghai, Beijing, Guangzhou and Shenzhen) are projected to be among the global top ten largest cities by nominal GDP according to a report by Oxford Economics.

title:China

url:<https://en.wikipedia.org/wiki?curid=5405>

views:4000

item 2

_additional: {'distance': -146.22166}

lang:en

text:The Liao fell to the Jurchen Jin dynasty in 1122, which gave the city to the Song dynasty and then retook it in 1125 during its conquest of northern China. In 1153, the Jurchen Jin made Beijing their "Central Capital", or Zhongdu. The city was besieged by Genghis Khan's invading Mongolian army in 1213 and razed to the ground two years later. Two generations later, Kublai Khan ordered the construction of Dadu (or Daidu to the Mongols, commonly known as Khanbaliq), a new capital for his Yuan dynasty to the northeast of the Zhongdu ruins. The construction took from 1264 to 1293, but greatly enhanced the status of a city on the northern fringe of China proper. The city was centered on the Drum Tower slightly to the north of modern Beijing and stretched from the present-day Chang'an Avenue to the northern part of Line 10 subway. Remnants of the Yuan rammed earth wall still stand and are known as the Tucheng.

title:Beijing

url:<https://en.wikipedia.org/wiki?curid=18603746>

views:3000

item 3

_additional: {'distance': -146.18498}

lang:en

text:Beijing (; ;), alternatively romanized as Peking (), is the capital of the People's Republic of China. It is the center of power and development of the country. Beijing is the world's most populous national capital city, with over 21 million residents. It has an administrative area of , the third in the country after Guangzhou and Shanghai. It is located in Northern China , and is governed as a municipality under the direct administration of the State Council with 16 urban, suburban, and rural districts. Beijing is mostly

surrounded by Hebei Province with the exception of neighboring Tianjin to the southeast; together, the three divisions form the Jingjinji megalopolis and the national capital region of China.

title:Beijing

url:https://en.wikipedia.org/wiki?curid=18603746

views:3000

item 4

_additional: {'distance': -146.12057}

lang:en

text:After China was reunified during the Sui dynasty, Jicheng, also known as Zhuojun, became the northern terminus of the Grand Canal. Under the Tang dynasty, Jicheng as Youzhou, served as a military frontier command center. During the An-Shi Rebellion and again amidst the turmoil of the late Tang, local military commanders founded their own short-lived Yan dynasties and called the city Yanjing, or the "Yan Capital." Also in the Tang dynasty, the city's name Jicheng was replaced by Youzhou or Yanjing. In 938, after the fall of the Tang, the Later Jin ceded the frontier territory including what is now Beijing to the Khitan Liao dynasty, which treated the city as Nanjing, or the "Southern Capital", one of four secondary capitals to complement its "Supreme Capital" Shangjing (modern Baarin Left Banner in Inner Mongolia). Some of the oldest surviving pagodas in Beijing date to the Liao period, including the Tianning Pagoda.

title:Beijing

url:https://en.wikipedia.org/wiki?curid=18603746

views:3000

Improving Keyword Search with ReRank

```
In [17]: query_1 = "What is the Capital of China?"
```

```
In [18]: query_1 = "What is the Capital of China?"
results = keyword_search(query_1,
                          client,
                          properties=["text", "title", "url", "views", "lang"]
                          num_results=3
                          )

for i, result in enumerate(results):
    print(f"i:{i}")
    print(result.get('title'))
    print(result.get('text'))
```

i:0

Early modern period

The Ming dynasty fell around 1644 to the ethnically Manchu Qing dynasty, which would be the last dynasty of China. The Qing ruled from 1644 to 1912, with a brief, abortive restoration in 1917. During its reign, the Qing dynasty adopted many of the outward features of Chinese culture in establishing its rule, but did not necessarily "assimilate", instead adopting a more universalist style of governance. The Manchus were formerly known as the Jurchens. When Beijing was captured by Li Zicheng's peasant rebels in 1644, the Chongzhen Emperor, the last Ming emperor, committed suicide. The Manchus then allied with former Ming general Wu Sangui and seized control of Beijing, which became the new capital of the Qing dynasty. The Manchus adopted the Confucian norms of traditional Chinese government in their rule of China proper. Schoppa, the editor of "The Columbia Guide to Modern Chinese History" argues, "A date around 1780 as the beginning of modern China is thus closer to what we know today as historical 'reality'. It also allows us to have a better baseline to understand the precipitous decline of the Chinese polity in the nineteenth and twentieth centuries."

i:1

China Global Television Network

In what CNN Business characterised as "an apparent tit-for-tat move", the Chinese government on 11 February banned the BBC World News TV channel from airing in China. Given that BBC World News could only be received in so-called foreign compounds (such as internationally owned hotels) in mainland China in the first place, it was unclear what impact, if any, this ban would have.

i:2

Jim Mattis

Speaking at a 2015 conference sponsored by The Heritage Foundation in Washington, D.C., Mattis said he believed that Russian President Vladimir Putin's intent is "to break NATO apart." Mattis has also spoken out against what he perceives as Russia's expansionist or bellicose policies in Syria, Ukraine and the Baltic states. In 2017, Mattis said that the world order is "under the biggest attack since World War II, ... and that is from Russia, from terrorist groups, and with what China is doing in the South China Sea."


```
In [19]: query_1 = "What is the capital of China?"
results = keyword_search(query_1,
                          client,
                          properties=["text", "title", "url", "views", "lang"],
                          num_results=500
                          )

for i, result in enumerate(results):
    print(f"i:{i}")
    print(result.get('title'))
    #print(result.get('text'))

i:0
Early modern period
i:1
China Global Television Network
i:2
Jim Mattis
i:3
Cloud seeding
i:4
Religion in China
i:5
Religion in China
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Religion in China
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New World
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Skyscanner
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Religion in Japan
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```

Revolutions of 1989
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```
In [20]: def rerank_responses(query, responses, num_responses=10):
          reranked_responses = co.rerank(
              model = 'rerank-english-v2.0',
              query = query,
              documents = responses,
              top_n = num_responses,
          )
          return reranked_responses
```

```
In [21]: texts = [result.get('text') for result in results]
          reranked_text = rerank_responses(query_1, texts)
```

```
In [22]: for i, rerank_result in enumerate(reranked_text):
          print(f"i:{i}")
          print(f"{rerank_result}")
          print()
```

i:0

RerankResult<document['text']: The early death of Zhu Yuanzhang's heir led to a succession struggle upon his death, one that ended with the victory of Zhu Di and the declaration of the new Yongle era. Since his harsh treatment of the Ming capital Yingtian (modern Nanjing) alienated many there, he established his fief as a new co-capital. The city of Beiping became Beijing ("Northern Capital") or Shuntian in 1403. The construction of the new imperial residence, the Forbidden City, took from 1406 to 1420; this period was also responsible for several other of the modern city's major attractions, such as the Temple of Heaven and Tian'anmen. On 28 October 1420, the city was officially designated the capital of the Ming dynasty in the same year that the Forbidden City was completed. Beijing became the empire's primary capital, and Yingtian, also called Nanjing ("Southern Capital"), became the co-capital. (A 1425 order by Zhu Di's son, the Hongxi Emperor, to return the primary capital to Nanjing was never carried out: he died, probably of a heart attack, the next month. He was buried, like almost every Ming emperor to follow him, in an elaborate necropolis to Beijing's north.), index: 109, relevance_score : 0.9034647>

i:1

RerankResult<document['text']: In January 1949, Beiping was taken by the Communists without a fight, and its name changed back to Beijing. Following the capture of Nanjing on 23 April, major cities passed from Kuomintang to Communist control with minimal resistance, through November. In most cases the surrounding countryside and small towns had come under Communist influence long before the cities. Finally, on 1 October 1949, Communists led by Mao Zedong founded the People's Republic of China. Chiang Kai-shek declared martial law in May 1949, whilst a few hundred thousand Nationalist troops and two million refugees, predominantly from the government and business community, fled

d from mainland China to Taiwan. There remained in China itself only isolated pockets of resistance. On 7 December 1949, Chiang proclaimed Taipei, Taiwan, the temporary capital of the Republic of China., index: 380, relevance_score: 0.8529355>

i:2

RerankResult<document['text']: "The Hollywood Reporter"s Angie Han believed "for a series set in the infinite vastness of a multiverse, "What If...?" is drearily small", with some "what if" concepts were not as compelling as others. She added that Wright gave each episode "a boost of gravitas", but noted the animation was awkward at times, with some scenes approaching the uncanny valley and that some of the returning actors gave "robotic" voice performances without the charisma of their live-action portrayals. She concluded, "Dare to hope for more than superficial amusement, though, and "What If...?" tends to disappoint... It's possible future episodes will do a better job of balancing big concepts with a half-hour run time, or that the season is building to some grander design. If that's the case, "What If...?" is taking its sweet time showing what it can do." Etan Anderson of "/Film" called the results of the first three episodes "mixed" with "some glaring shortcomings", such as the "clunky" animation when it was not showing action sequences, the voice acting from some of the returning stars, and the short run times which did not allow enough time for viewers to "fully engage" with these new versions of characters. Anderson added that some of the humor struggled and felt "awkwardly contrived" and believed "the creators seem to be trying too hard to keep the secrets of the series instead of being more forthcoming about the exciting twists and turns within". He concluded that this appeared to be the first Marvel Studios series that might not be "necessary viewing" and one that could be "an uphill battle" for general audiences to continue watching, though dedicated fans would find "What If...?" to be "a satisfying remix". Following the release of the first season, Adam B. Vary of "Variety" said the season had been "a fascinating experiment for Marvel Studios", with "fizzy adventures... [that] also leaned into real darkness"., index: 496, relevance_score: 0.78133065>

i:3

RerankResult<document['text']: Following the Marco Polo Bridge Incident, the Japanese scored major victories, capturing Beijing, Shanghai and the Chinese capital of Nanjing in 1937, which resulted in the Rape of Nanjing. After failing to stop the Japanese in the Battle of Wuhan, the Chinese central government was relocated to Chongqing (Chungking) in the Chinese interior. Following the Sino-Soviet Treaty of 1937, strong material support helped the Nationalist Army of China and the Chinese Air Force continue to exert strong resistance against the Japanese offensive. By 1939, after Chinese victories in Changsha and Guangxi, and with Japan's lines of communications stretched deep into the Chinese interior, the war reached a stalemate. While the Japanese were also unable to defeat Chinese Communist Party (CCP) forces in Shaanxi, who waged a campaign of sabotage and guerrilla warfare against the invaders, they ultimately succeeded in the year-long Battle of South Guangxi to occupy Nanning, which cut off the last sea access to the wartime capital of Chongqing. While Japan ruled the large cities, they lacked sufficient manpower to control China's vast countryside. In November 1939, Chinese nationalist forces launched a large scale winter offensive, while in August 1940, CCP forces launched a counteroffensive in central China. The United States supported Ch

ina through a series of increasing boycotts against Japan, culminating with cutting off steel and petrol exports into Japan by June 1941. Additionally, American mercenaries such as the Flying Tigers provided extra support to China directly., index: 429, relevance_score: 0.76348376>

i:4

RerankResult<document['text']: In 1945, at the end of World War II, the Empire of Japan surrendered control of Taiwan and its island groups to the Allies; and Taiwan was placed under the Republic of China's administrative control. The communist takeover of mainland China in 1949, after the Chinese Civil War, left the ruling Kuomintang with control over only Taiwan, Penghu, Kinmen, Matsu, and other minor islands. With the loss of the mainland, the ROC government retreated to Taiwan and the KMT declared Taipei the provisional capital. Meanwhile, the CCP took over all of mainland China and founded the People's Republic of China (PRC) in Beijing., index: 312, relevance_score: 0.6679062>

i:5

RerankResult<document['text']: After Yuan Shikai's death in 1916, China was politically fragmented. Its Beijing-based government was internationally recognized but virtually powerless; regional warlords controlled most of its territory. In the late 1920s, the Kuomintang under Chiang Kai-shek, the then Principal of the Republic of China Military Academy, was able to reunify the country under its own control with a series of deft military and political maneuvers, known collectively as the Northern Expedition. The Kuomintang moved the nation's capital to Nanjing and implemented "political tutelage", an intermediate stage of political development outlined in Sun Yat-sen's Sanmin program for transforming China into a modern democratic state. The political division in China made it difficult for Chiang to battle the communist-led People's Liberation Army (PLA), against whom the Kuomintang had been warring since 1927 in the Chinese Civil War. This war continued successfully for the Kuomintang, especially after the PLA retreated in the Long March, until Japanese aggression and the 1936 Xi'an Incident forced Chiang to confront Imperial Japan., index: 407, relevance_score: 0.6266955>

i:6

RerankResult<document['text']: Under Emperor Wu of Han, the Han dynasty made China the regional power in East Asia, projecting much of its imperial power on its neighbours. Han China hosted the largest unified population in East Asia, the most literate and urbanised as well as being the most economically developed, as well as the most technologically and culturally advanced civilization in the region at the time. Cultural and religious interaction between the Chinese and other regional East Asian dynasties and kingdoms occurred. China's impact and influence on Korea began with the Han dynasty's northeastern expansion in 108 BC when the Han Chinese conquered the northern part of the Korean peninsula and established a province called Lelang. Chinese influence would soon take root in Korea through the inclusion of the Chinese writing system, monetary system, rice culture, and Confucian political institutions. Jomon society in ancient Japan incorporated wet-rice cultivation and metallurgy through its contact with Korea. Starting from the fourth century AD, Japan incorporated the Chinese writing system which evolved into Kanji by the fifth century AD and has become a significant part of the Japanese writing system. Utilizing the Chinese writing system allowed the Japanese to cond

uct their daily activities, maintain historical records and give form to various ideas, thoughts, and philosophies. During the Tang dynasty, China exerted its greatest influence on East Asia as various aspects of Chinese culture spread to Japan and Korea. As full-fledged medieval East Asian states were established, Korea by the fourth century AD and Japan by the seventh century AD, Japan and Korea actively began to incorporate Chinese influences such as Confucianism, the use of written Han characters, Chinese style architecture, state institutions, political philosophies, religion, urban planning, and various scientific and technological methods into their culture and society through direct contacts with Tang China and succeeding Chinese dynasties. Drawing inspiration from the Tang political system, Prince Naka no oe launched the Taika Reform in 645 AD where he radically transformed Japan's political bureaucracy into a more centralised bureaucratic empire. The Japanese also adopted Mahayana Buddhism, Chinese style architecture, and the imperial court's rituals and ceremonies, including the orchestral music and state dances had Tang influences. Written Chinese gained prestige and aspects of Tang culture such as poetry, calligraphy, and landscape painting became widespread. During the Nara period, Japan began to aggressively import Chinese culture and styles of government which included Confucian protocol that served as a foundation for Japanese culture as well as political and social philosophy. The Japanese also created laws adopted from the Chinese legal system that was used to govern in addition to the kimono, which was inspired from the Chinese robe (hanfu) during the eighth century AD. For many centuries, most notably from the 7th to the 14th centuries, China stood as East Asia's most advanced civilization and foremost military and economic power exerting its influence as the transmission of advanced Chinese cultural practices and ways of thinking greatly shaped the region up until the nineteenth century., index: 255, relevance_score: 0.60777956>

i:7

RerankResult<document['text']: Foreign investment remains a strong element in China's rapid expansion in world trade and has been an important factor in the growth of urban jobs. China's economic leadership on global capital flows emphasizes long-term infrastructure and development finance over short-term flows which, under the current order, have imposed large costs on many economies. In 1998, foreign-invested enterprises produced about 40% of China's exports, and foreign exchange reserves totalled about \$145billion. Foreign-invested enterprises today produce about half of China's exports (the majority of China's foreign investment come from Hong Kong, Macau and Taiwan), and China continues to attract large investment inflows. However, the Chinese government's emphasis on guiding FDI into manufacturing has led to market saturation in some industries, while leaving China's services sectors underdeveloped. From 1993 to 2001, China was the world's second-largest recipient of foreign direct investment (FDI) after the United States, receiving \$39billion in 1999 and \$41billion in 2000. China is now one of the leading FDI recipients in the world, receiving almost \$80billion in 2005 according to World Bank statistics. In 2006, China received \$69.47billion. By 2011, with the U.S. seeing a decline in foreign investment following the 2008 financial crisis, China overtook it as the top destination for FDI, receiving over \$280billion that year., index: 62, relevance_score: 0.5042342>

i:8

RerankResult<document['text']: Direct foreign investment in China, which tot

aled about US\$1.6trillion as of the end of October 2016, directly and indirectly contributed about one-third of China's GDP and a quarter of jobs there. As of the end of June 2020, FDI stock in China reached US\$2.947trillion, and China's outgoing FDI stock stood at US\$2.128trillion. The total foreign financial assets owned by China reached US\$7.860trillion, and its foreign financial liabilities US\$5.716trillion, making China the second largest creditor nation after Japan in the world., index: 111, relevance_score: 0.47110158>

i:9

RerankResult<document['text']: The territory of China lies between latitudes 18° and 54° N, and longitudes 73° and 135° E. The geographical center of China is marked by the Center of the Country Monument at . China's landscapes vary significantly across its vast territory. In the east, along the shores of the Yellow Sea and the East China Sea, there are extensive and densely populated alluvial plains, while on the edges of the Inner Mongolian plateau in the north, broad grasslands predominate. Southern China is dominated by hills and low mountain ranges, while the central-east hosts the deltas of China's two major rivers, the Yellow River and the Yangtze River. Other major rivers include the Xi, Mekong, Brahmaputra and Amur. To the west sit major mountain ranges, most notably the Himalayas. High plateaus feature among the more arid landscapes of the north, such as the Taklamakan and the Gobi Desert. The world's highest point, Mount Everest (8,848 m), lies on the Sino-Nepalese border. The country's lowest point, and the world's third-lowest, is the dried lake bed of Ayding Lake (-154 m) in the Turpan Depression., index: 133, relevance_score: 0.4404091>

Improving Dense Retrieval with ReRank

```
In [23]: query_2 = "Who is the tallest person in history?"
```

```
In [24]: results = dense_retrieval(query_2,client)
```

```
In [25]: for i, result in enumerate(results):
          print(f{i}:{i}")
          print(result.get('title'))
          print(result.get('text'))
          print()
```


i:0

Robert Wadlow

Robert Pershing Wadlow (February 22, 1918 July 15, 1940), also known as the Alton Giant and the Giant of Illinois, was a man who was the tallest person in recorded history for whom there is irrefutable evidence. He was born and raised in Alton, Illinois, a small city near St. Louis, Missouri.

i:1

Manute Bol

Bol came from a family of extraordinarily tall men and women. He said: "My mother was , my father , and my sister is . And my great-grandfather was even taller-." His ethnic group, the Dinka, and the Nilotic people of which they are a part, are among the tallest populations in the world. Bol's hometown, Turalei, is the origin of other exceptionally tall people, including basketball player Ring Ayuel. "I was born in a village, where you cannot measure yourself," Bol reflected. "I learned I was 7 foot 7 in 1979, when I was grown. I was about 18 or 19."

i:2

Sultan Kösen

Sultan Kösen (born 10 December 1982) is a Turkish farmer who holds the Guinness World Record for tallest living male at . Of Kurdish ethnicity, he is the seventh tallest man in history.

i:3

Sultan Kösen

Kösen turned 40 years old on 10 December 2022. He celebrated his birthday a few days early by visiting the Ripley's Believe It or Not! museum in Orlando , Florida, USA and posing next to a life-sized statue of Robert Wadlow, the tallest man ever at 272 cm (8 ft 11.1 in).

i:4

Netherlands

The Dutch are the tallest people in the world, by nationality, with an average height of for adult males and for adult females in 2009. The average height of young males in the Netherlands increased from 5 feet, 4 inches to approximately 6 feet between the 1850s until the early 2000s. People in the south are on average about shorter than those in the north.

```
In [26]: texts = [result.get('text') for result in results]
reranked_text = rerank_responses(query_2, texts)
```

```
In [27]: for i, rerank_result in enumerate(reranked_text):
          print(f"i:{i}")
          print(f"{rerank_result}")
          print()
```

i:0

RerankResult<document['text']: Robert Pershing Wadlow (February 22, 1918 July 15, 1940), also known as the Alton Giant and the Giant of Illinois, was a man who was the tallest person in recorded history for whom there is irrefutable evidence. He was born and raised in Alton, Illinois, a small city near St. Louis, Missouri., index: 0, relevance_score: 0.9734939>

i:1

RerankResult<document['text']: Sultan Kösen (born 10 December 1982) is a Turkish farmer who holds the Guinness World Record for tallest living male at . Of Kurdish ethnicity, he is the seventh tallest man in history., index: 2, relevance_score: 0.8664718>

i:2

RerankResult<document['text']: The Dutch are the tallest people in the world , by nationality, with an average height of for adult males and for adult females in 2009. The average height of young males in the Netherlands increased from 5 feet, 4 inches to approximately 6 feet between the 1850s until the early 2000s. People in the south are on average about shorter than those in the north., index: 4, relevance_score: 0.80162543>

i:3

RerankResult<document['text']: Kösen turned 40 years old on 10 December 2022 . He celebrated his birthday a few days early by visiting the Ripley's Believe It or Not! museum in Orlando, Florida, USA and posing next to a life-sized statue of Robert Wadlow, the tallest man ever at 272 cm (8 ft 11.1 in)., index: 3, relevance_score: 0.6874202>

i:4

RerankResult<document['text']: Bol came from a family of extraordinarily tall men and women. He said: "My mother was , my father , and my sister is . And my great-grandfather was even taller-." His ethnic group, the Dinka, and the Nilotic people of which they are a part, are among the tallest populations in the world. Bol's hometown, Turalei, is the origin of other exceptionally tall people, including basketball player Ring Ayuel. "I was born in a village, where you cannot measure yourself," Bol reflected. "I learned I was 7 foot 7 in 1979, when I was grown. I was about 18 or 19.", index: 1, relevance_score: 0.6396235>