

MAC - Labo 3 : Indexing and Search with Elasticsearch

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Contents

| | |
|--------------------------------------|-----------|
| 2.2 Indexing | 2 |
| D.1 | 3 |
| D.2 | 4 |
| D.3 | 5 |
| D.4 | 5 |
| D.5 | 5 |
| 2.3 Reading Index | 6 |
| D.6 | 6 |
| D.7 | 6 |
| 2.4 Using different Analyzers | 7 |
| D.8 | 7 |
| D.9 | 12 |
| D.10 | 12 |
| D.11 | 13 |
| D.12 | 13 |
| D.13 | 14 |

2.2 Indexing

Using the following pipeline:

PUT `_ingest/pipeline/my_pipeline`

```
{
  "processors": [
    {
      "csv": {
        "field": "_row",
        "target_fields": [
          "id",
          "author",
          "title",
          "date",
          "summary"
        ],
        "separator": "\t",
        "quote": "§"
      }
    },
    {
      "split": {
        "field": "author",
        "separator": ";",
        "ignore_missing": true
      }
    },
    {
      "remove": {
        "field": "_row"
      }
    }
  ]
}
```

D.1

API requests to create **cacm_standard**:

Mappings:

PUT /cacm_standard

```
{
  "mappings": {
    "properties": {
      "author": {
        "type": "keyword"
      },
      "date": {
        "type": "date"
      },
      "id": {
        "type": "unsigned_long"
      },
      "summary": {
        "type": "text",
        "fielddata": true
      },
      "title": {
        "type": "text",
        "fielddata": true
      }
    }
  }
}
```

Reindex:

POST _reindex

```
{
  "source": {
    "index": "cacm_raw"
  },
  "dest": {
    "index": "cacm_standard",
    "pipeline": "my_pipeline"
  }
}
```

D.2

API requests to create `cacm_termvector`:

Mappings:

```
PUT /cacm_termvector
{
  "mappings": {
    "properties": {
      "author": {
        "type": "keyword"
      },
      "date": {
        "type": "date"
      },
      "id": {
        "type": "unsigned_long"
      },
      "summary": {
        "type": "text",
        "term_vector": "with_positions"
      },
      "title": {
        "type": "text"
      }
    }
  }
}
```

Reindex:

```
POST _reindex
{
  "source": {
    "index": "cacm_raw"
  },
  "dest": {
    "index": "cacm_termvector",
    "pipeline": "my_pipeline"
  }
}
```

D.3

API request to query a term vector:

```
GET /cacm_termvector/_termvectors/gNa1ZYAB7VfE5TWZZFs7
```

gNa1ZYAB7VfE5TWZZFs7 being the ID of a document that has a `summary` field

D.4

The official documentation of Elasticsearch describes a term vector as the following:

Term vectors contain information about the terms produced by the analysis process, including:

- *A list of terms.*
- *The position (or order) of each term.*
- *The start and end character offsets mapping the term to its origin in the original string.*
- *Payloads (if they are available) — user-defined binary data associated with each term position.*

D.5

Sizes of the indexes:

- `cacm_raw` : **1.34MB**
- `cacm_standard` : **1.48MB**
- `cacm_termvector` : **2.07MB**

2.3 Reading Index

D.6

Using the following request, we observe that **Thacher Jr., H. C.** is the author with the highest number of publications. He has **38** publications.

Request:

```
GET /cacm_standard/_search
{
  "aggs": {
    "genres": {
      "terms": {
        "field": "author",
        "size": 1
      }
    }
  }
}
```

D.7

Using the following request, we observe that the top 10 terms are:

1. *of*
2. *algorithm*
3. *a*
4. *for*
5. *the*
6. *and*
7. *in*
8. *on*
9. *an*
10. *computer*

Request:

```
GET /cacm_standard/_search
{
  "aggs": {
    "genres": {
      "terms": {
        "field": "title",
        "size": 10
      }
    }
  }
}
```

2.4 Using different Analyzers

D.8

The following requests create indexes with the required analyzers.

whitespace analyzer

PUT /cacm_standard_whitespace

```
{
  "settings": {
    "analysis": {
      "analyzer": "whitespace"
    }
  },
  "mappings": {
    "properties": {
      "id":{"type": "unsigned_long"},
      "author": {"type": "keyword"},
      "title":{"type": "text", "fielddata": true},
      "date":{"type": "date"},
      "summary":{"analyzer" : "whitespace", "type": "text", "fielddata" : true}
    }
  }
}
```

POST _reindex

```
{
  "source": {
    "index": "cacm_raw"
  },
  "dest": {
    "index": "cacm_standard_whitespace",
    "pipeline": "my_pipeline"
  }
}
```

english analyzer

PUT /cacm_standard_english

```
{
  "settings": {
    "analysis": {
      "analyzer": "english"
    }
  },
  "mappings": {
    "properties": {
      "id":{"type": "unsigned_long"},
      "author": {"type": "keyword"},
      "title":{"type": "text", "fielddata": true},
      "date":{"type": "date"},
      "summary":{"analyzer": "english", "type": "text", "fielddata" : true}
    }
  }
}
```

POST _reindex

```
{
  "source": {
    "index": "cacm_raw"
  },
  "dest": {
    "index": "cacm_standard_english",
    "pipeline": "my_pipeline"
  }
}
```


standard analyzer with shingles of size 1 and 2

PUT /cacm_standard_myanalyzer1

```
{
  "settings": {
    "analysis": {
      "analyzer": {
        "my_analyzer1": {
          "type": "custom",
          "tokenizer": "standard",
          "filter": [
            "lowercase",
            "custom_shingle"
          ]
        }
      },
      "filter": {
        "custom_shingle": {
          "type": "shingle",
          "max_shingle_size": 2
        }
      }
    }
  },
  "mappings": {
    "properties": {
      "id": { "type": "unsigned_long" },
      "author": { "type": "keyword" },
      "title": { "type": "text",
        "fielddata": true },
      "date": { "type": "date" },
      "summary": { "analyzer": "my_analyzer1", "type": "text", "fielddata": true }
    }
  }
}
```

POST _reindex

```
{
  "source": {
    "index": "cacm_raw"
  },
  "dest": {
    "index": "cacm_standard_myanalyzer1",
    "pipeline": "my_pipeline"
  }
}
```

standard analyzer with shingles of size 3

PUT /cacm_standard_myalyzer2

```
{
  "settings": {
    "analysis": {
      "analyzer": {
        "my_analyzer2": {
          "type": "custom",
          "tokenizer": "standard",
          "filter": [
            "lowercase",
            "custom_shingle"
          ]
        }
      },
      "filter": {
        "custom_shingle": {
          "type": "shingle",
          "min_shingle_size": 3,
          "max_shingle_size": 3
        }
      }
    }
  },
  "mappings": {
    "properties": {
      "id": { "type": "unsigned_long" },
      "author": { "type": "keyword" },
      "title": { "type": "text", "fielddata": true },
      "date": { "type": "date" },
      "summary": {"analyzer": "my_analyzer2", "type": "text", "fielddata": true }
    }
  }
}
```

POST _reindex

```
{
  "source": {
    "index": "cacm_raw"
  },
  "dest": {
    "index": "cacm_standard_myalyzer2",
    "pipeline": "my_pipeline"
  }
}
```

stop analyzer

PUT /cacm_standard_stopwords

```
{
  "settings": {
    "analysis": {
      "analyzer": {
        "stopwords": {
          "tokenizer": "lowercase",
          "filter": [ "custom_stopwords" ]
        }
      },
      "filter" : {
        "custom_stopwords" : {
          "type" : "stop",
          "stopwords_path" : "data/common_words.txt"
        }
      }
    },
    "mappings": {
      "properties": {
        "id": { "type": "unsigned_long" },
        "author": { "type": "keyword" },
        "title": { "type": "text", "fielddata": true },
        "date": { "type": "date" },
        "summary": { "analyzer" : "stopwords", "type": "text", "fielddata": true }
      }
    }
  }
}
```

POST _reindex

```
{
  "source": {
    "index": "cacm_raw"
  },
  "dest": {
    "index": "cacm_standard_stopwords",
    "pipeline": "my_pipeline"
  }
}
```

D.9

Explanation of the analyzers, according to the Elasticsearch documentation:

- **whitespace** : Breaks text into terms whenever a whitespace is encountered.
- **english** : Targeted for english text. It features relevant stop words, plural to singular conversion and other similar language-specific filters.
- **standard** with shingles of size 1 and 2 : Produce shingles (or word n-gram) up to a size of two,

The text "I Love MAC" would produce ["I", "I Love", "Love", "Love MAC", "MAC"].

- **standard** with shingles of size 3 only : Produce shingles (or word n-gram) of size 3,

The text "I Love MAC" would produce ["I", "I Love MAC", "Love", "MAC"].

- **stop** : Uses a list of words as stop words that will be removed from the the requested text.

D.10

Using the Index stats and search APIs with the following types of requests:

```
GET /${INDEX_NAME}/_stats
```

```
GET /${INDEX_NAME}/_search
```

The results are:

| Analyzer type: | whitespace | english | standard shingles 1-2 | standard shingles 3 | stop |
|----------------|--|---|---|---|---|
| a) | 3'202 docs | 3'202 docs | 3'202 docs | 3'202 docs | 3'202 docs |
| b) | 103'275 terms | 72'298 terms | 237'189 terms | 242'248 terms | 59'988 terms |
| c) | of the is and a to in for The are | which us comput program system present describ paper can gener | the of a is and to in for are of the | the of a is and to in for are this | computer system paper presented time program data method algorithm discussed |
| d) | 13'542'719 B | 19'859'606 B | 2'597'942 B | 3'615'184 B | 2'833'980 B |
| e) | 350 ms | 250 ms | 340 ms | 300 ms | 340 ms |

D.11

Several statements can be made regarding the previous results, here are our 3 concluding ones:

1. All the indexes have the same number of document, the presentation of the documents is not altered.
2. The shingle-based indexes have the most terms. This make sense because they are the only indexes that add new terms in summary (the shingles).
3. The custom stop words provided in `stop` are more restrictive than the default ones of `english`. This is confirmed by the lower number of terms in the `stop` index.

D.12

Here are the API requests of the relevant queries:

1.

```
GET /cacm_standard_english/_search
{
  "query" : {
    "query_string" : {
      "query" : "Information Retrieval",
      "default_field": "summary"
    }
  },
  "_source": "id"
}
```

2.

```
GET /cacm_standard_english/_search
{
  "query" : {
    "query_string" : {
      "query" : "Information AND Retrieval",
      "default_field": "summary"
    }
  },
  "_source": "id"
}
```

3.

```
GET /cacm_standard_english/_search
{
  "query" : {
    "query_string" : {
      "query" : "(Retrieval OR (Retrieval AND Information)) AND NOT Database",
      "default_field": "summary"
    }
  },
  "_source": "id"
}
```

4.

```
GET /cacm_standard_english/_search
{
  "query" : {
    "query_string" : {
      "query" : "Info*",
      "default_field": "summary"
    }
  },
  "_source": "id"
}
```

5.

```
GET /cacm_standard_english/_search
{
  "query" : {
    "query_string" : {
      "query" : "\"Information Retrieval\"~5",
      "default_field": "summary"
    }
  },
  "_source": "id"
}
```

D.13

Here are the results of the previous API requests:

1. **240** hits
2. **36** hits
3. **69** hits
4. **205** hits
5. **30** hits