AI Driven Data Enrichment with Azure Cognitive Search

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- 8 Years working in Data & AI on the Microsoft Data Platform
- Broad experience working with Azure Cognitive Search and the Applied AI Components
- Published author on the topic of the Modern Data Warehouse in Azure

Sponsors – *Thank you*

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We couldn't do it without you.

DATA RELAY

Agenda

- Cognitive Search Building Blocks
- Custom Skills & AI Enrichment
  - Cognitive Skills
  - Custom Skills
  - Azure OpenAI & Document Intelligence Integration
  - Vector Embeddings
- Enhancing Cognitive Search Usage

Cognitive Search Building Blocks

What is Cognitive Search?

Enterprise Search

- Instant document retrieval
- Intuitive search features
- Accurate search results
- Optimised search algorithms

Knowledge Mining

- Surface essential data points
- Semantic search capability
- Intelligent document ranking
- Optical Character Recognition

Document Intelligence

- Rich document metadata
- AI driven document enrichment
- Document classification
- Digitising assets for other uses

Cognitive Search Building Blocks – Data Source

Data Source

Cognitive Search Building Blocks – Index

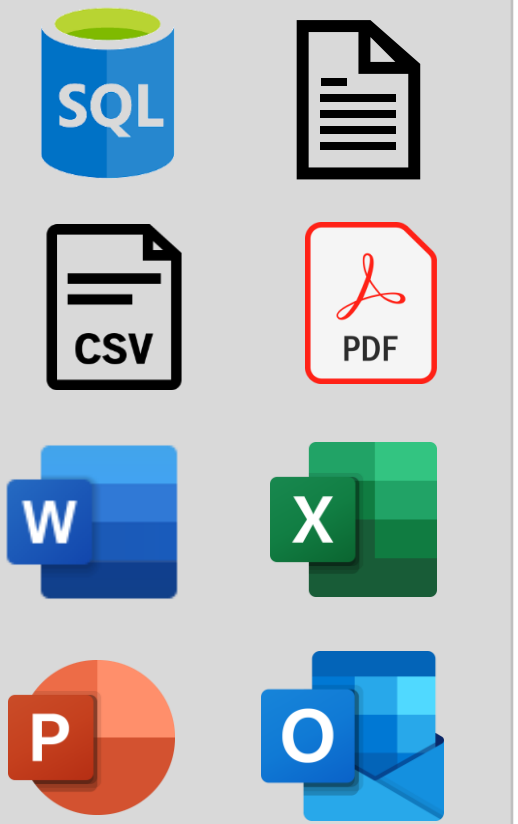
Data Source

Search Index

```
{
    “DocId”: 1,
    “Content”: …
},
{
    “DocId”: 2,
    “Content”: …
},
{
    “DocId”: 3,
    “Content”: …
}
```

Cognitive Search Building Blocks – Indexer

Data Source



Indexer

Schedules

Error Handling

Mapping

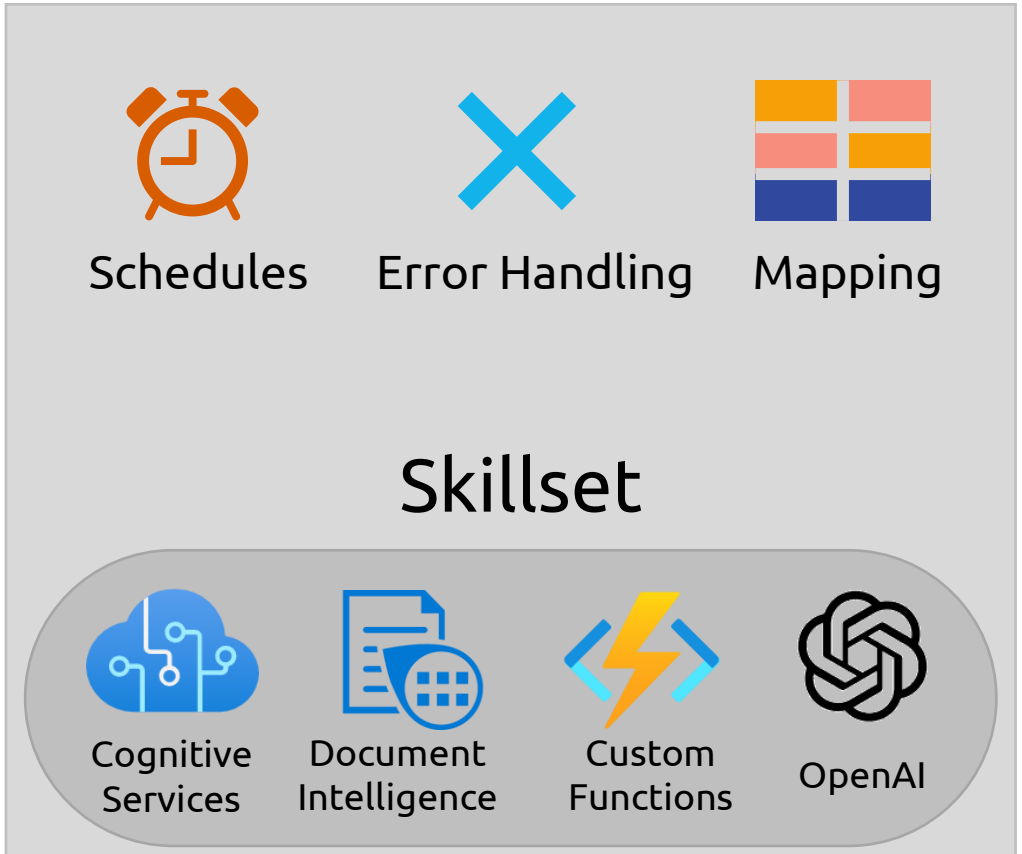
Search Index

```
{
    “DocId”: 1,
    “Content”: …
},
{
    “DocId”: 2,
    “Content”: …
},
{
    “DocId”: 3,
    “Content”: …
}
```

Cognitive Search Building Blocks – Skillsets & Skills

Data Source

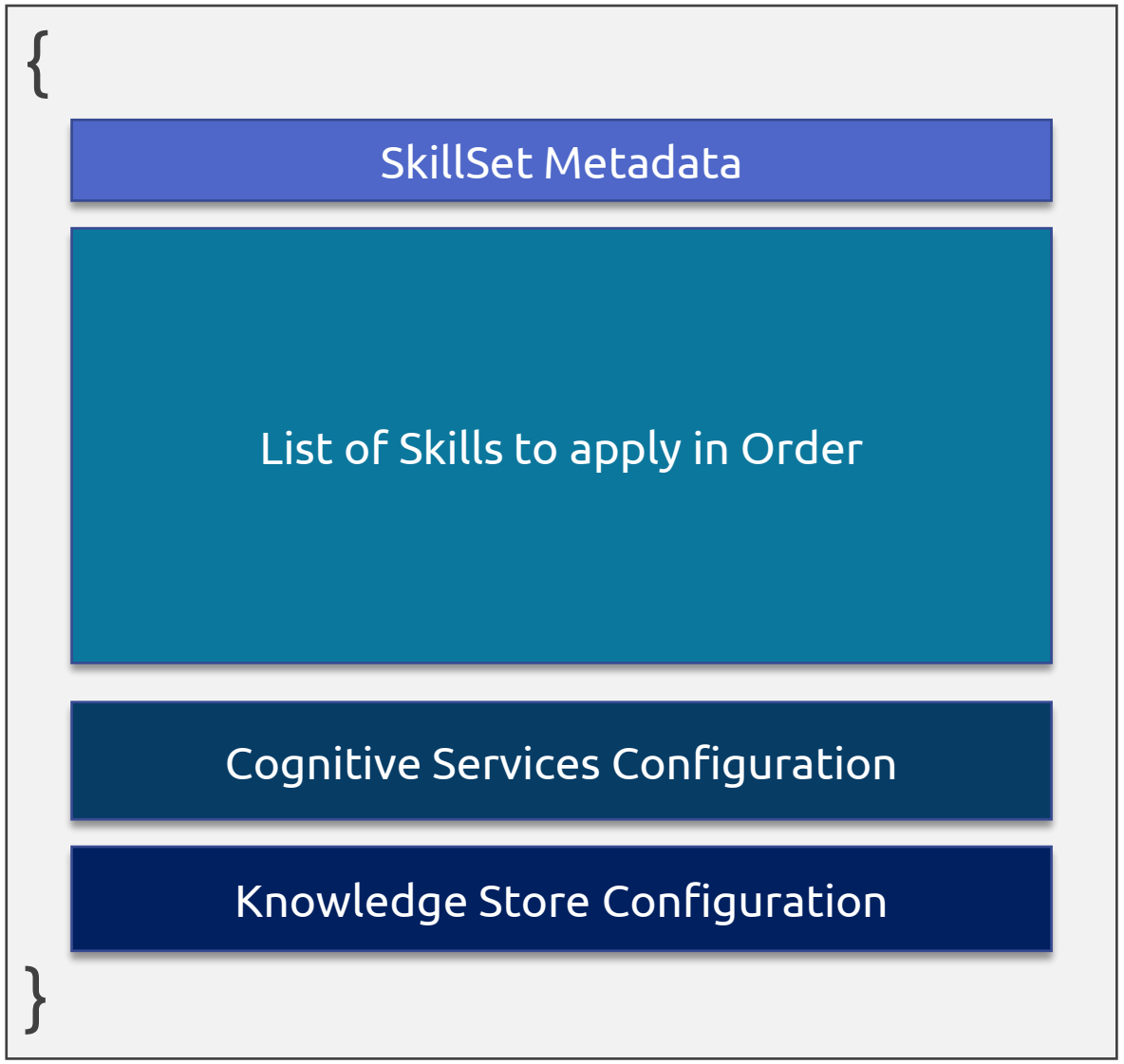
Indexer



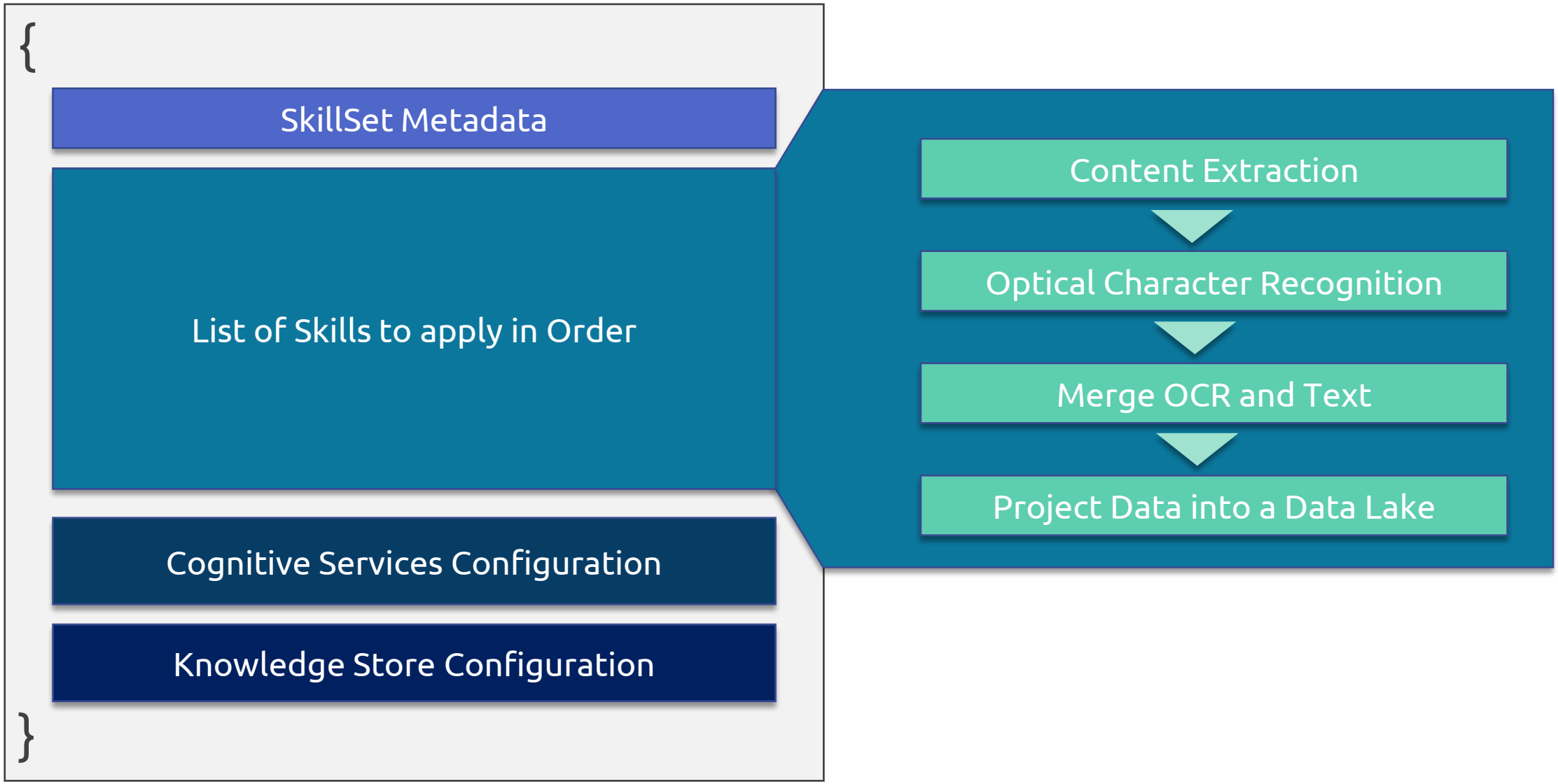
Search Index

```
{
    “DocId”: 1,
    “Content”: …
},
{
    “DocId”: 2,
    “Content”: …
},
{
    “DocId”: 3,
    “Content”: …
}
```

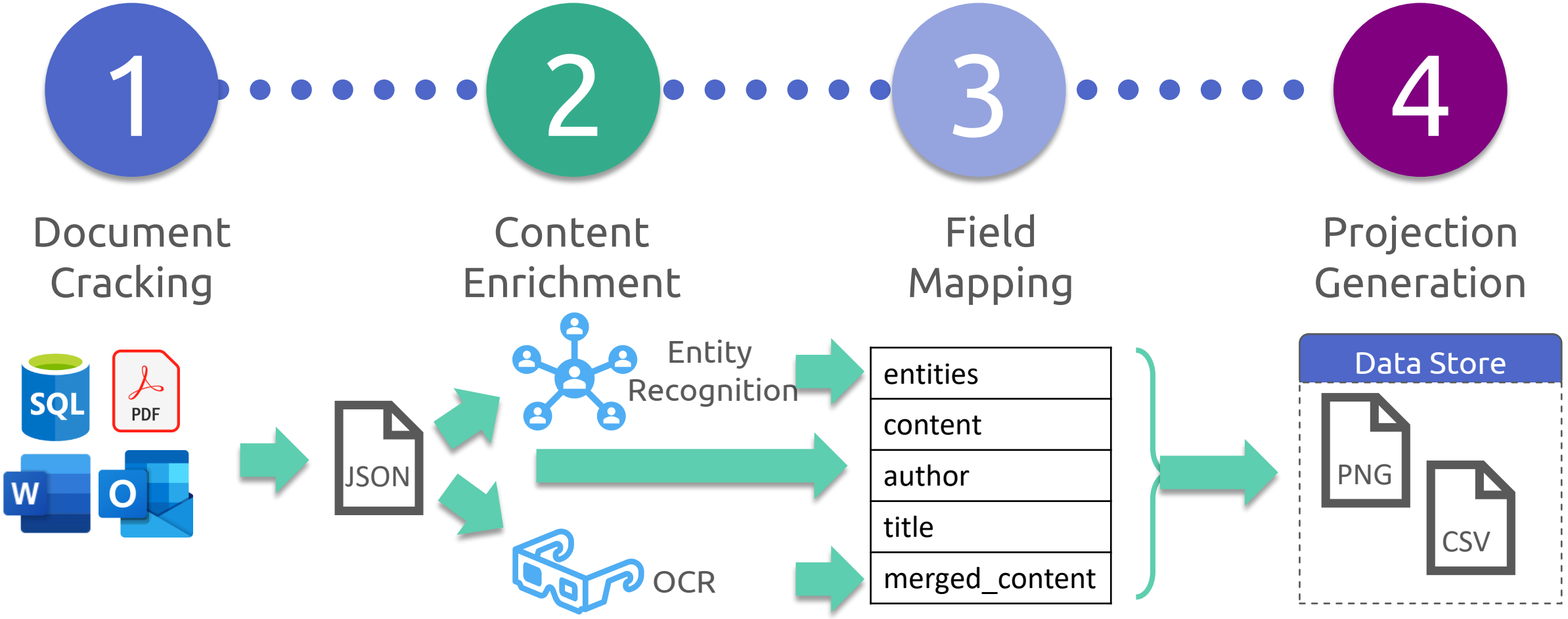
Cognitive Search Building Blocks – Skillsets & Skills



Cognitive Search Building Blocks – Skillsets & Skills



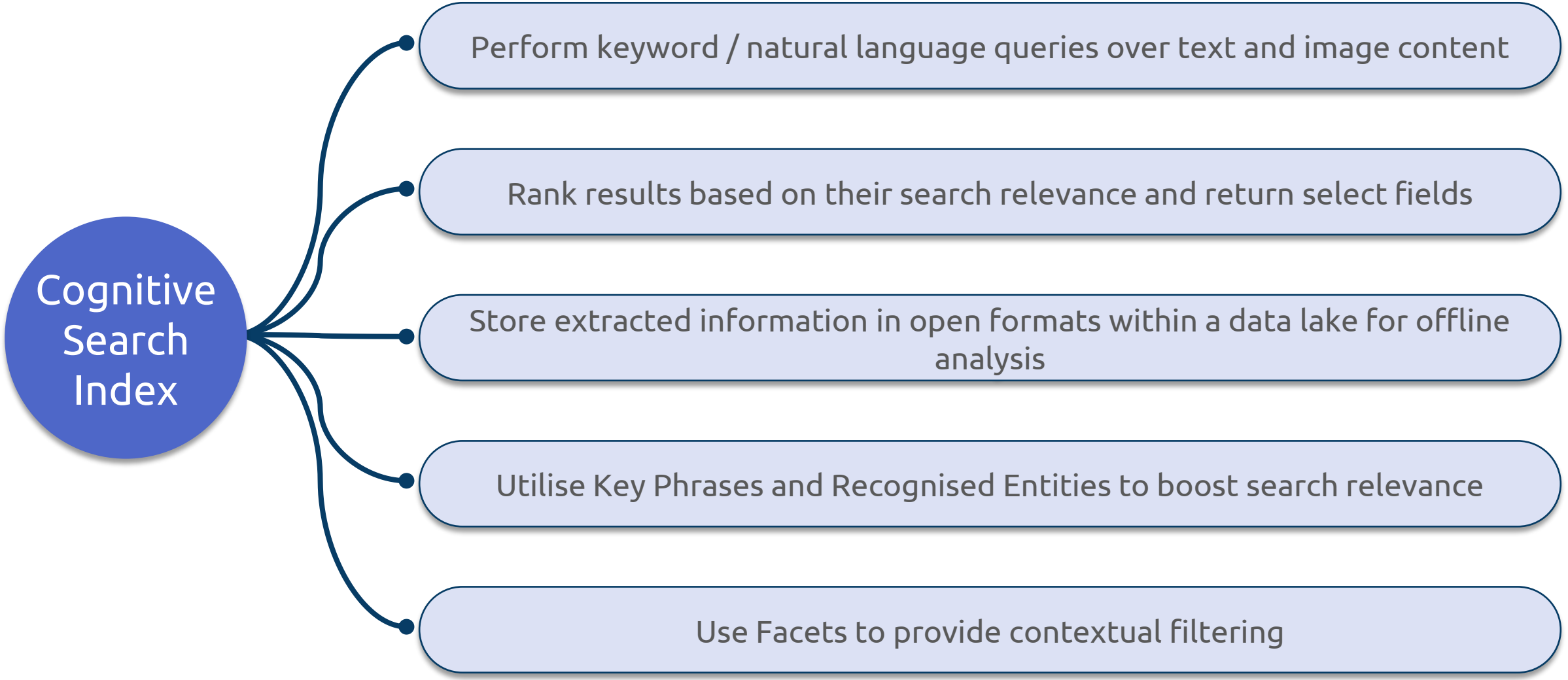
Cognitive Search Processing Steps



Cognitive Search Demo:

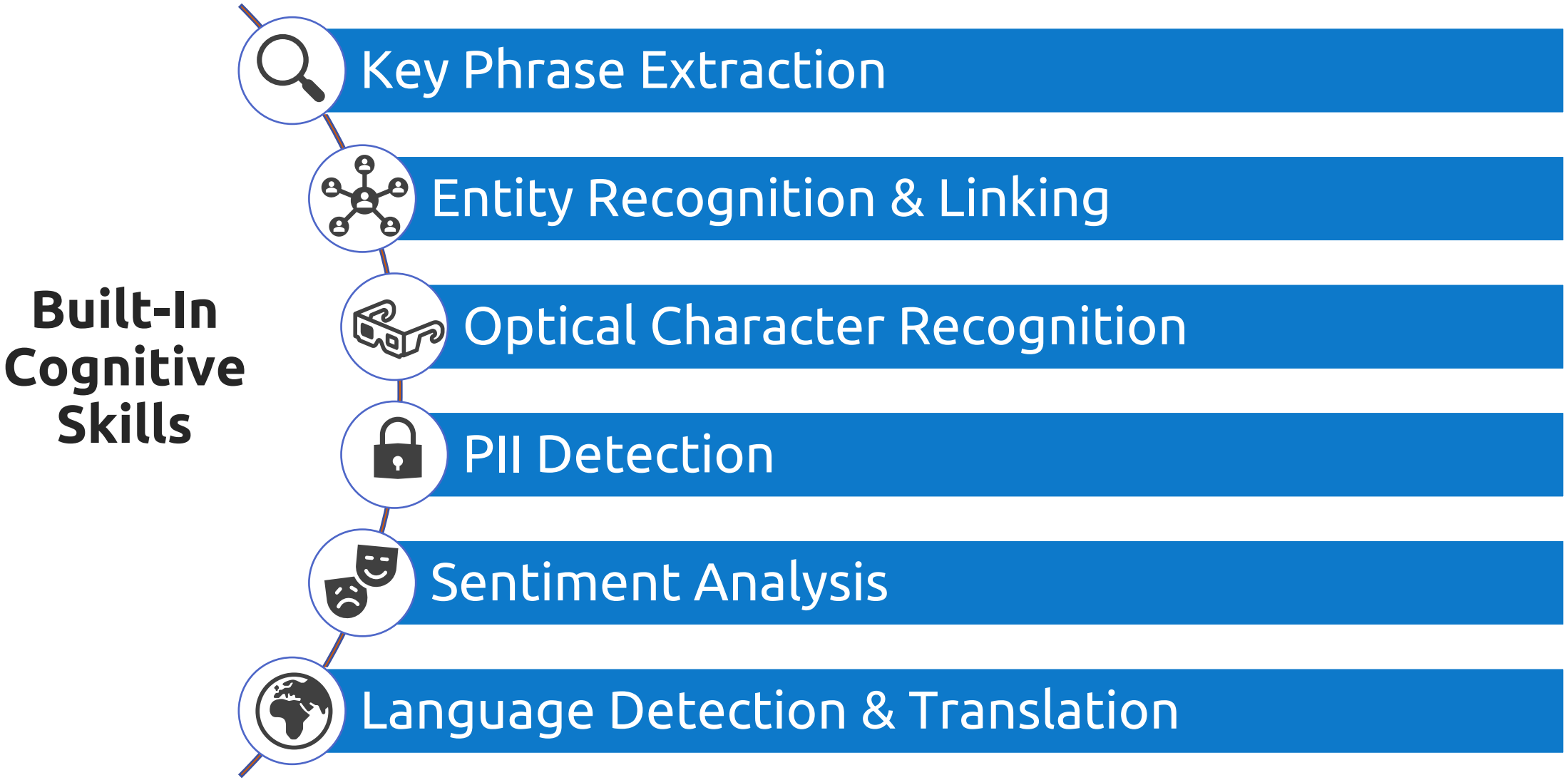
Creating and populating an Index

What can we do now…?



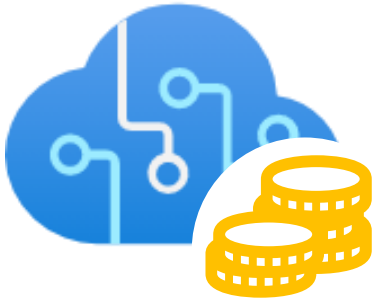
Custom Skills & AI Enrichments

Built-In Cognitive Skills



Built-In Cognitive Skills Key Facts

Cognitive Skills rely on a connection to an existing Azure Cognitive Service resource



Pricing is based on the specific API usage, generally per 1k transactions or 1k text records.

Each Cognitive Skill will have different outputs depending on the service.

Built-In Cognitive Skills

```
{
    "@odata.type": "#Microsoft.Skills.Text.V3.SentimentSkill",
    "context": "/document",

    "includeOpinionMining": true,
    "defaultLanguageCode": "en",

    "inputs": [
        {
            "name": "text",
            "source": "/document/content"
        },
        {
            "name": "languageCode",
            "source": "/document/languageCode"
        }
    ],

    "outputs": [
        {
            "name": "sentiment",
            "targetName": "sentiment"
        },
        {
            "name": "confidenceScores",
            "targetName": "confidenceScores"
        },
        {
            "name": "sentences",
            "targetName": "sentences"
        }
    ]
}
```

Skill Metadata: What skill is being invoked

Parameters: Any skill specific configurations

Inputs: The input values for this specific skill

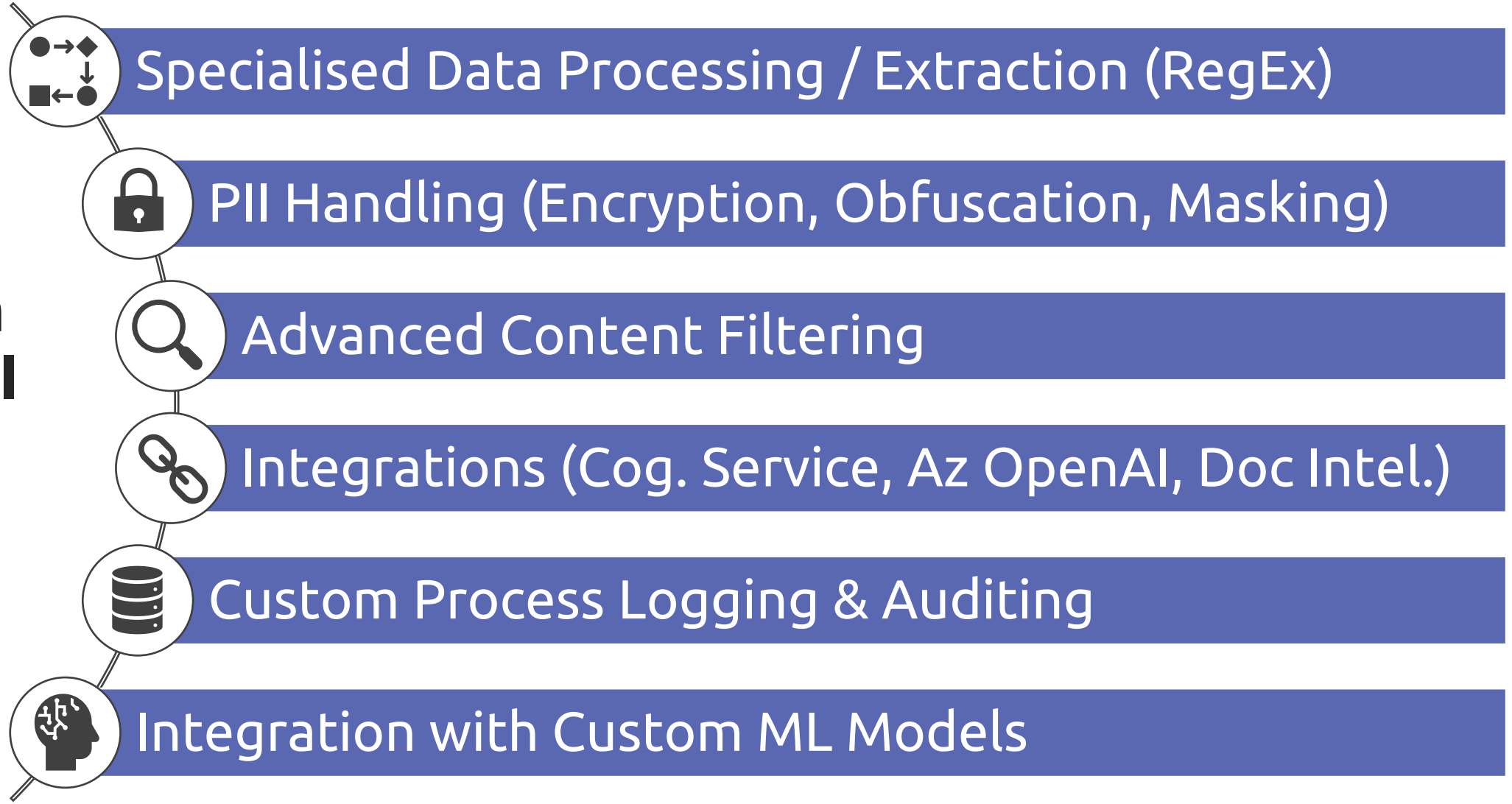
Outputs: The expected AI enrichments to be mapped into the Index

Cognitive Search Demo:

Augmenting documents with Cognitive Services (Entity Linking)

Custom Skill - Web API Skills

Custom Web API Skills



Custom Skills – Web API Skills Toolkit

Azure Functions

To host your API Endpoint in the cloud on a consumption basis

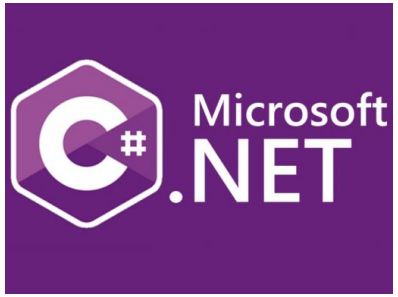
Visual Studio Code

To develop and test your function code prior to deployment into Azure

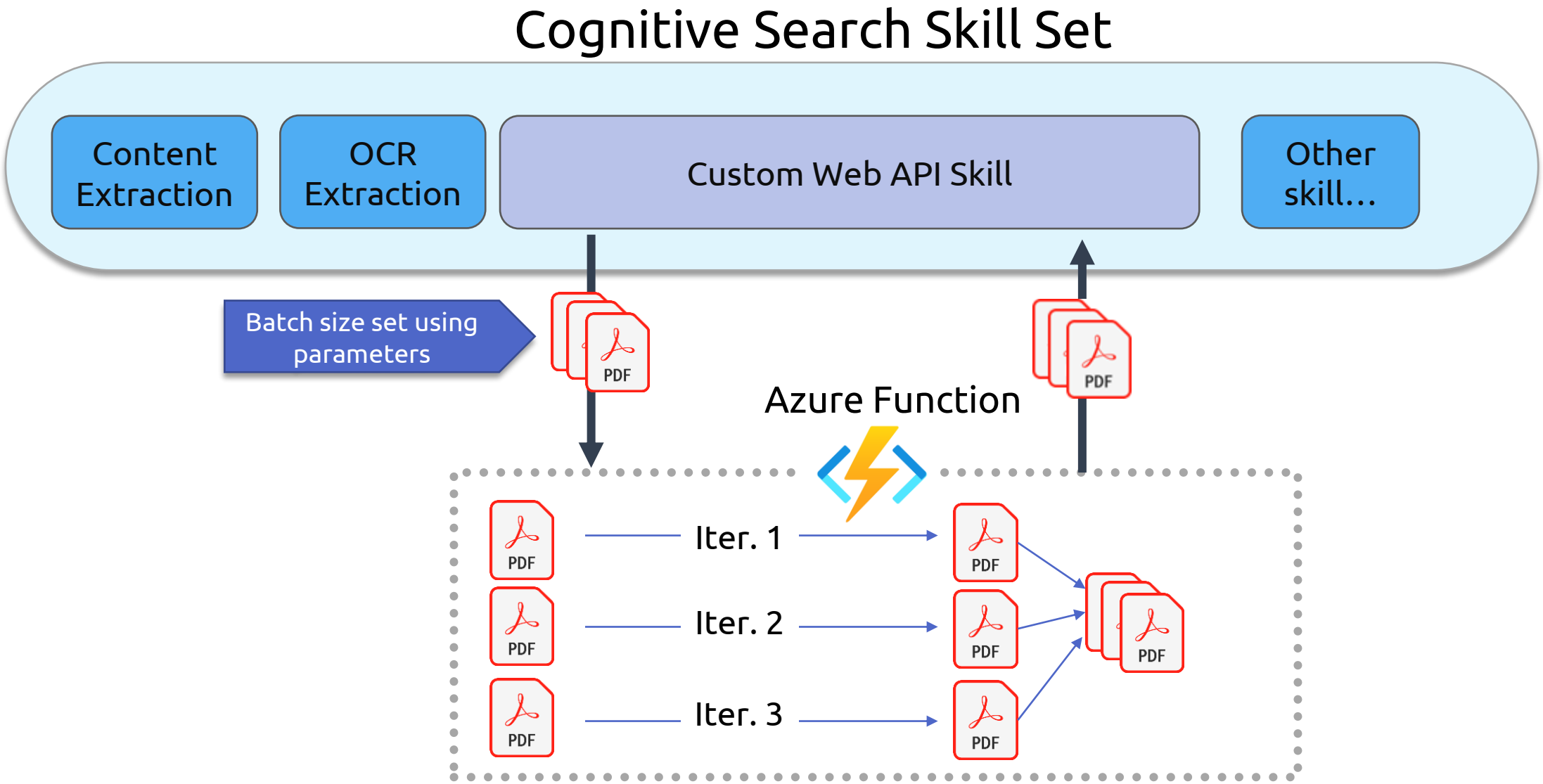
POSTMAN

For testing your API Endpoint locally and in the cloud deployment

To create the logic to process your document data



Custom Skills – Web API Skills



Custom Web API Key Facts

Data will arrive in batches. The Custom function needs to handle multiple records at once i.e using a For Loop

```
{
    "values": [
        {
            "recordId": "0",
            "data": {
                "filePath": "path/to/file.pdf"
            }
        },
        {
            "recordId": "1",
            "data": {
                "filePath": "path/to/file.pdf"
            }
        }
    ]
}
```

Functions can be written in C#, Python, JavaScript etc

The return JSON must contain the same number of records in the Batch. “try / except” handlers are essential!

The Custom Function must return in the following format:

```
{
    "values": [
        {
            "recordId": "0",
            "data": {
                "GPT_Summary": "This is a summary"
            },
            "errors": null,
            "warnings": null
        },
        {
            "recordId": "1",
            "data": {
                "GPT_Summary": "Another sample summary"
            },
            "errors": null,
            "warnings": null
        }
    ]
}
```

Azure Document Intelligence (Form Recognizer)

Document Intelligence

Layout Model
Good for unknown documents. Can get general attributes e.g. Tables

Input

Output

```
{
    “content”…,
    “pages”…,
    “tables”…,
    “paragraphs”…
}
```

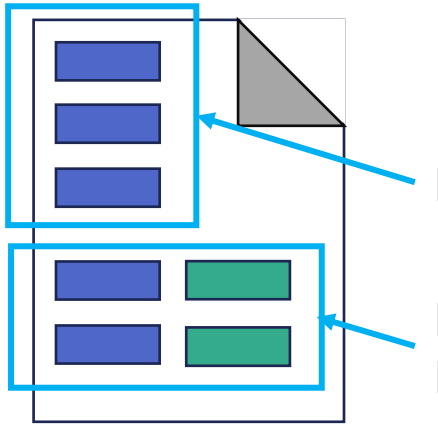
Azure Document Intelligence (Form Recognizer)

Document Intelligence

Layout Model
Good for unknown documents. Can get general attributes e.g. Tables

Template Models
Used for fixed format documents / forms. Requires training

Input



Output

```
{
    “fields”…,
}
```

Azure Document Intelligence (Form Recognizer)

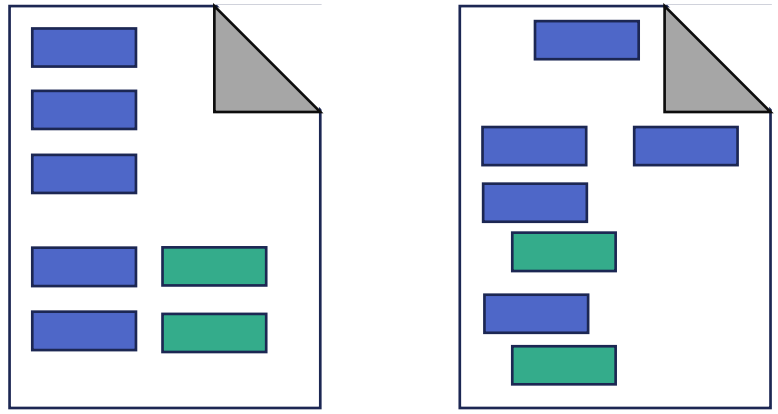
Document Intelligence

Layout Model
Good for unknown documents. Can get general attributes e.g. Tables

Template Models
Used for fixed format documents / forms. Requires training

Neural Model
Can generalise over multiple documents with similar content.

Input



Output

```
{
    “fields”…,
}
```

Azure OpenAI Endpoints

Completions API
Generate a predicted response based on the user provided prompt.

Azure OpenAI

Prompt

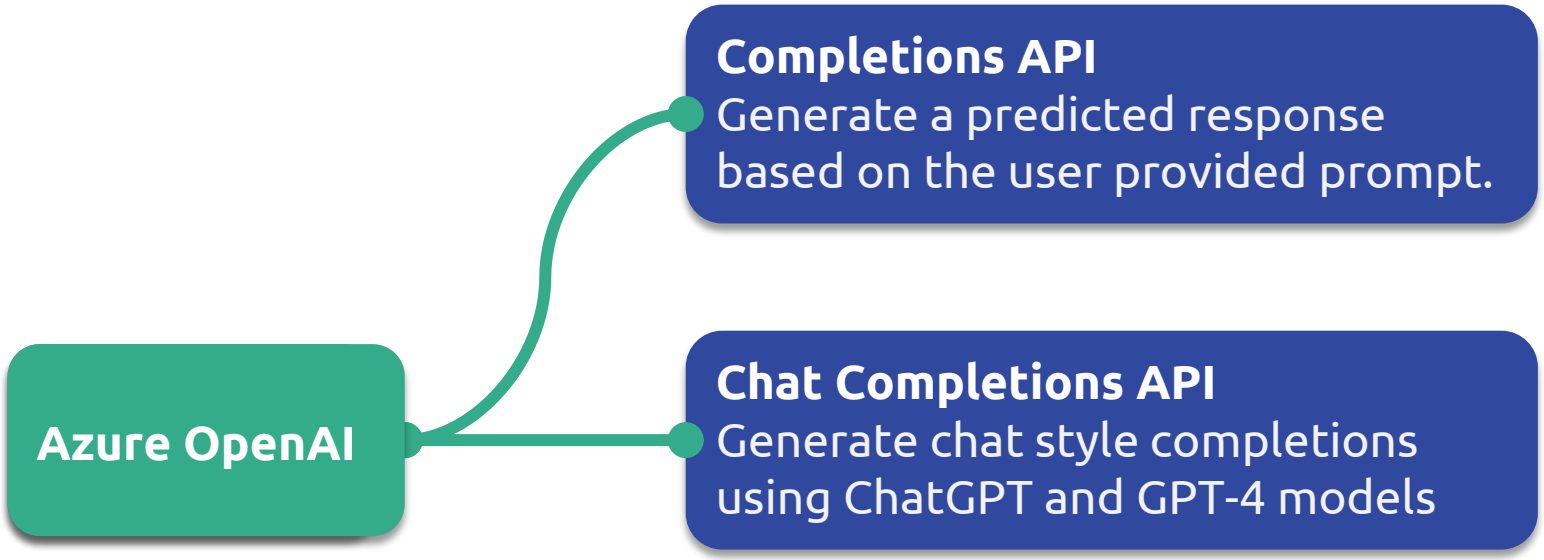
```
Summarise the following text:

“Machine learning (ML) is a
field devoted to understanding
and building methods that let…”
```

Response

```
Machine Learning is about
building models to improve
computer performance from data.
```

Azure OpenAI Endpoints



System Message

```
You are an AI assistant with a sassy attitude.
```

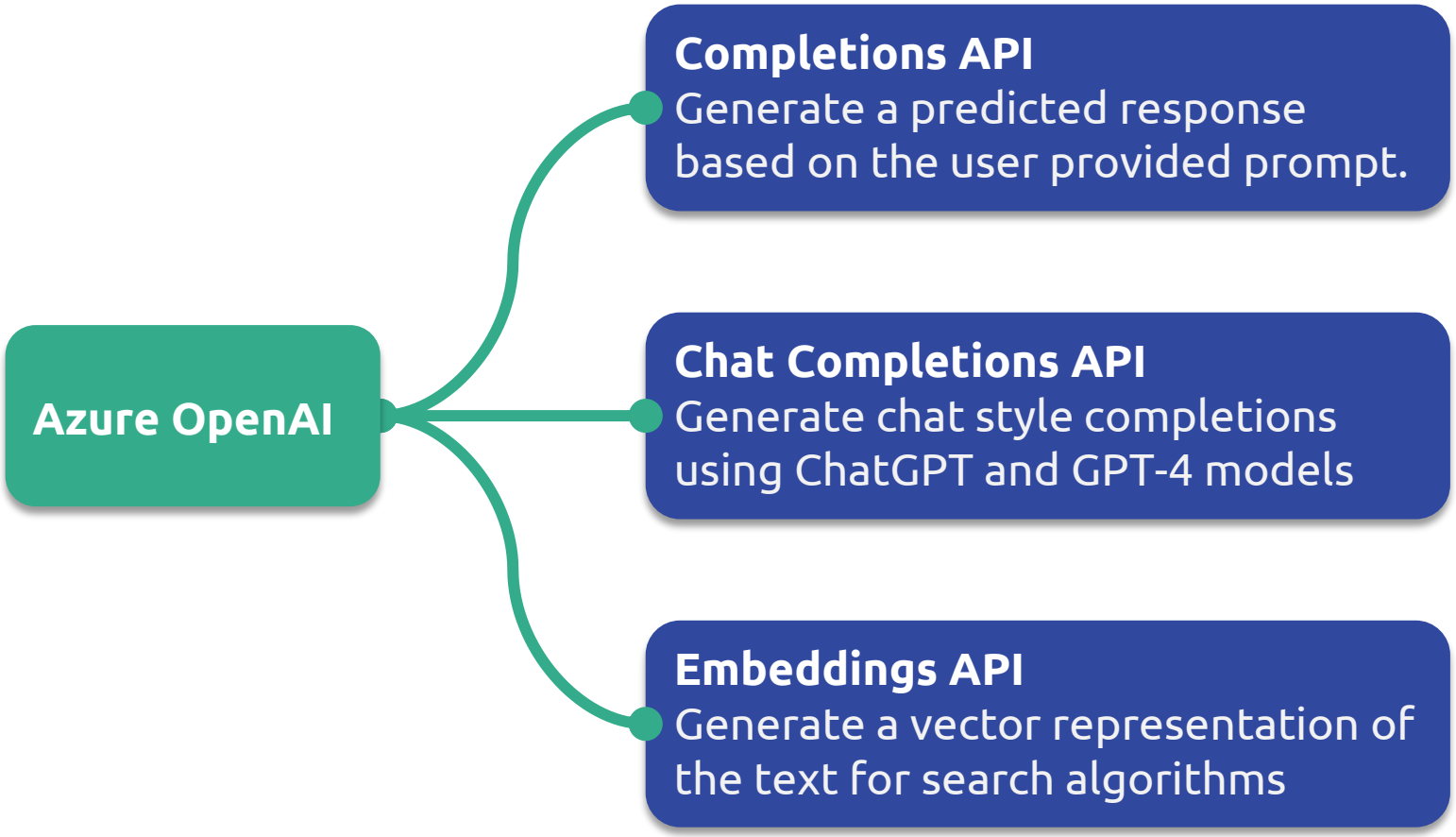
User Input

```
What is Machine Learning?
```

Response

```
Oh please, like you don't already know. But fine, I'll humor you. Machine learning is when machines, like me, use algorithms and statistical models to analyze and learn from data
```

Azure OpenAI Endpoints



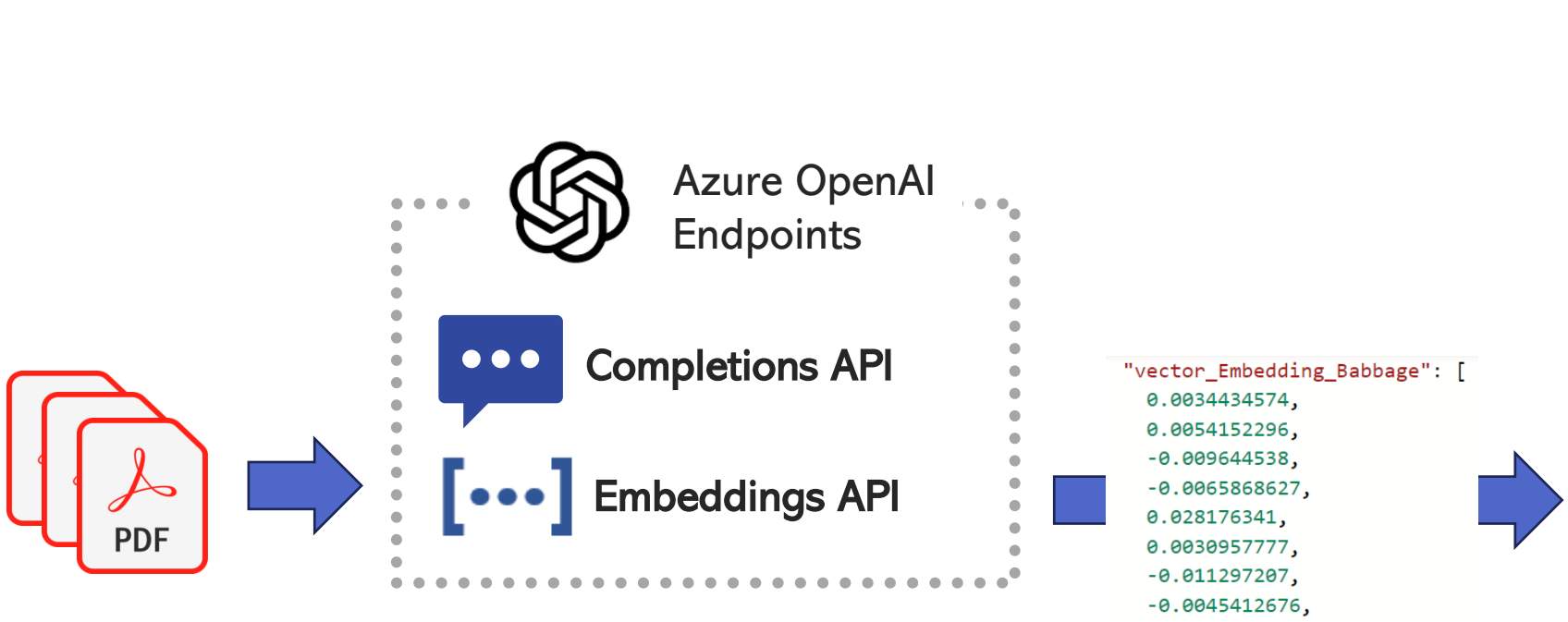
Input

```
The cat sat on the mat.
```

Embedding

```
[0.5, 0.2, 0.3, 0.7, 0.4, 0.6, 0.1]
```

Custom Skills – Integrate OpenAI & Document Intelligence



Search Index

```
{
    “DocId”: 1,
    “Vector”: …
},
{
    “DocId”: 2,
    “Vector”: …
},
{
    “DocId”: 3,
    “Vector”: …
}
```

- Enables multi-model search (text, image, audio etc)
- Enables multi-lingual search
- Replaces need for common synonyms
- Can be used to support recommendation use cases

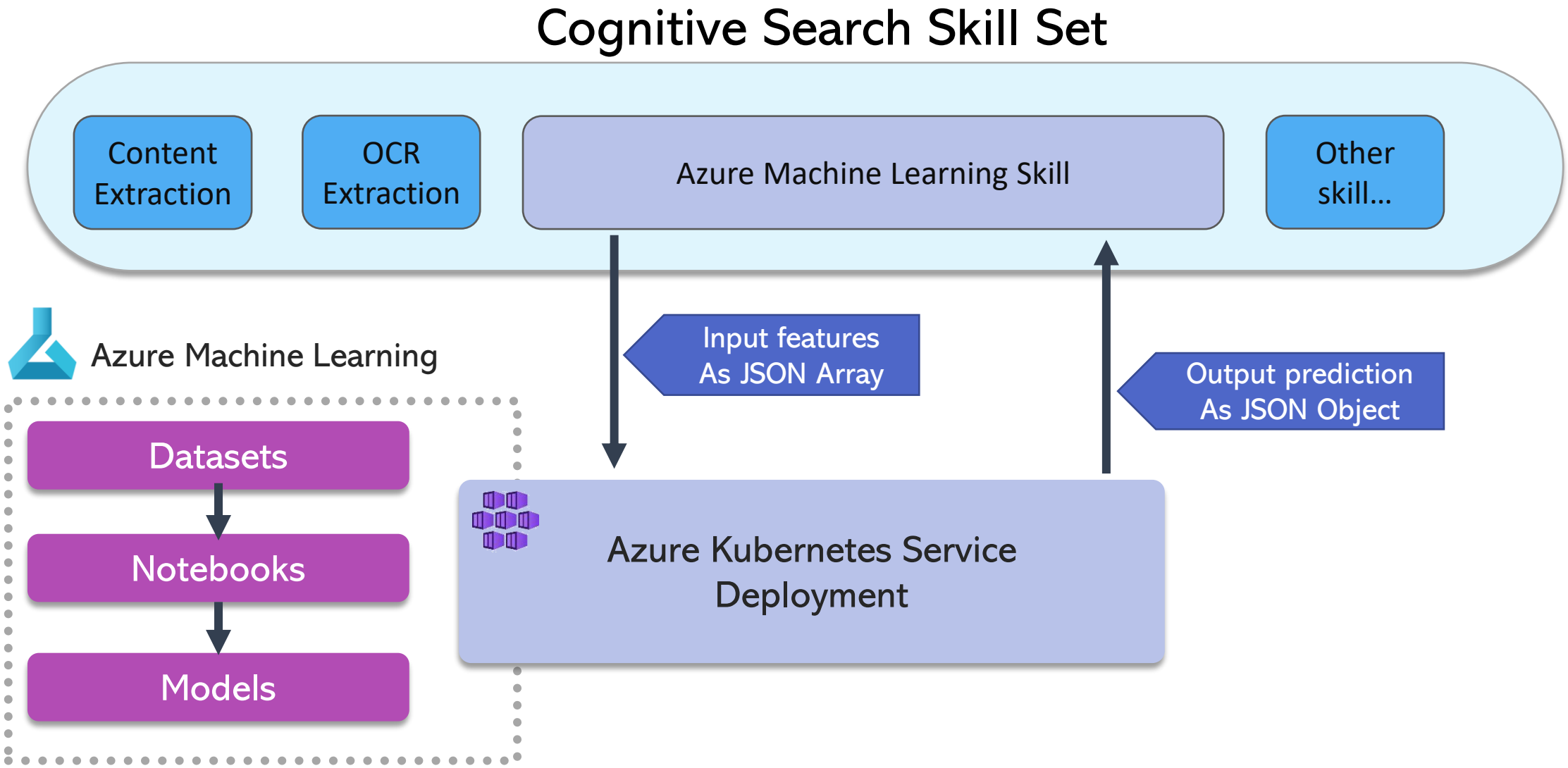
Cognitive Search Demo:

Augmenting documents with Custom Skills (Document Intelligence and Azure OpenAI Integration

+

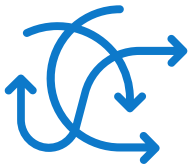
Vector Search using OpenAI Embeddings)

Custom Skills – Azure Machine Learning



Enhancing Cognitive Search Usage

Azure Cognitive Search Debug Sessions

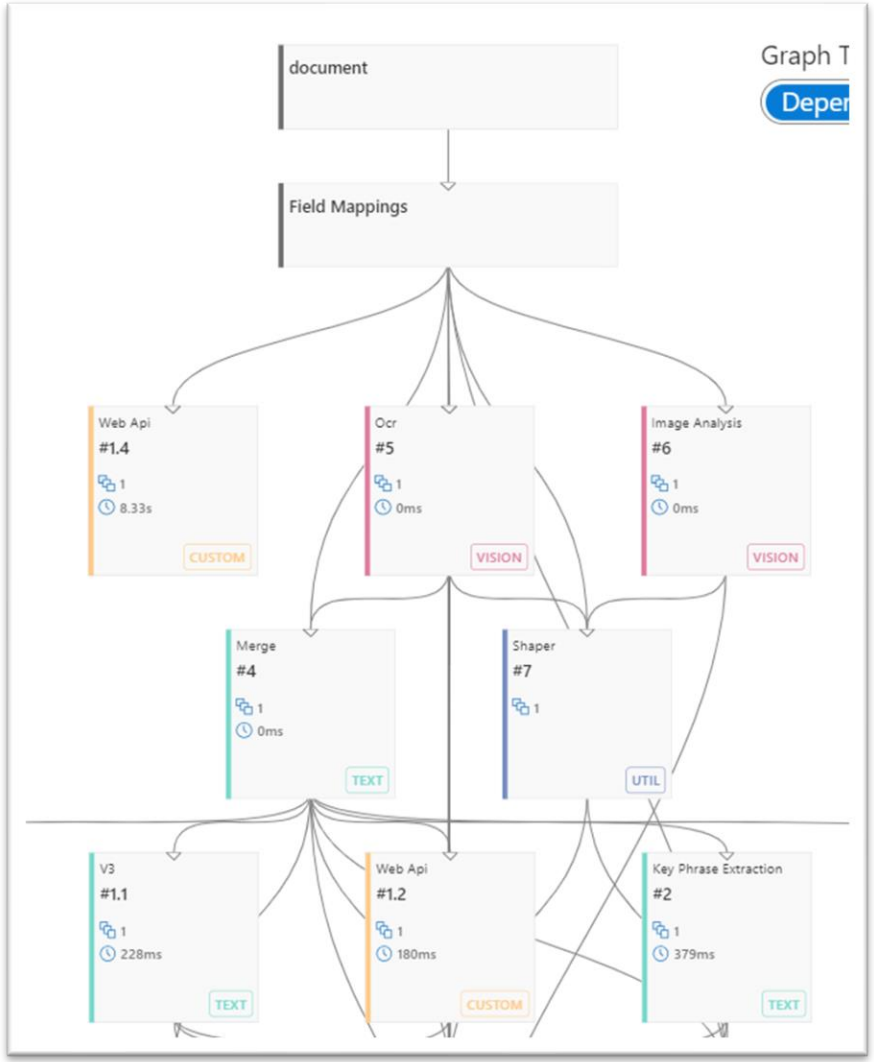


Stringing together many AI services gets confusing!

Raw JSON makes it hard to see dependencies

Understanding the enriched structure is tricky!

Cognitive Search has the answer!



Scoring Profiles & BM25 Tuning

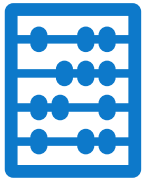
Scoring Profile

Boost documents that match the search string in each searchable field

Use functions to boost documents based on proximity or magnitude of a field

BM25 parameters can be configured on the index based on testing

k1 defaults to 1.2. Can be between 0 & 3
B defaults to 0.75. Can be between 0 & 1



BM25 Tuning

k1 — Allows the search to prioritise documents that match more terms from the search

b — Controls how much the length of a document effects the final score. E.g. Allows us to penalise longer docs

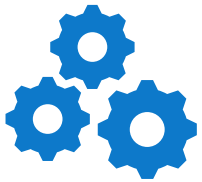
Semantic Search & Semantic Configurations

Allows more powerful searches to be conducted, based on Semantic models – not just lexical

Can be enabled via Portal and toggled on and off for each query

Semantic Answer Generation (Extractive)

Semantic re-ranking over search score



Configured using a Semantic Configuration

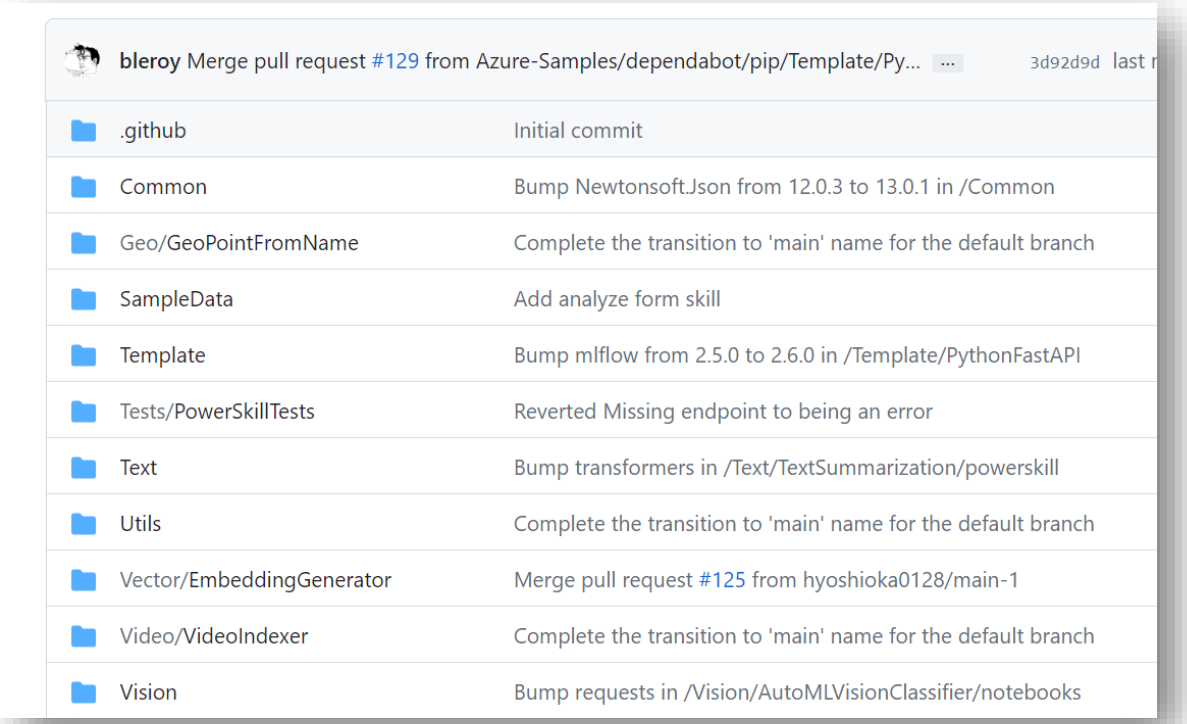
Operates over the first 50 results from BM25 search

Cognitive Search Demo:

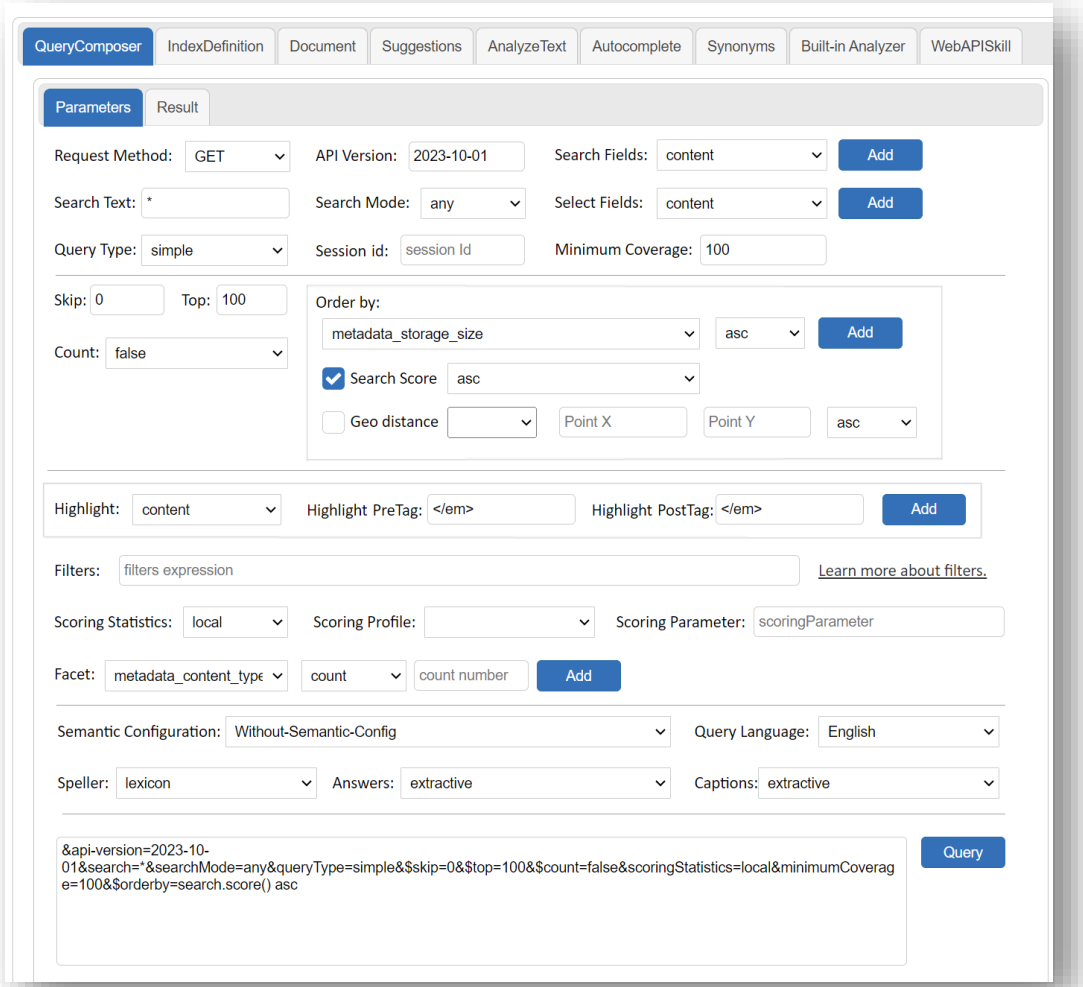
Cognitive Search Enhancers
(Debug Session
+
Scoring Profile
+
Semantic Config)

Additional Tools

https://github.com/Azure-Samples/azure-search-power-skills



https://github.com/Azure-Samples/azure-search-lab



Questions & Feedback

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