# Modern Document Data Modelling beyond the AI Era


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**National Coding Day 2026 (24-Jan-2026)**

# Introduction

- The Shift in Data Ecosystem
  - ➢ Common (Text, Number, Date)
  - ➢ Vector
  - ➢ Metadata
- Challenges of Integrating AI with Legacy Systems

# MongoDB Schema Design Patterns for AI

- Data that is used together should be stored together.
- The Attribute Pattern & Metadata Management
- The Extended Reference Pattern
- Handling Large Content: The Outlier Pattern
- Chat History with Bucket Pattern

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# Embedding Data Model


```
{
  "topic": "ปี 2026 มือถือยี่ห้อไหน มีน้ำหนักเบา",
  "topic_vector": [0.123, -0.456, 0.789, 0.012, ...]
   "top_comments": [
      { "user": "JoJoBar", "comment": "EyePhone Ah 9" },
      { "user": "Kaken", "comment": "Somesongs Slim 10"}
    ]
}
```

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# Simple Pattern


```
{
    "name": "Modern Data Science Laptop",
    "description": "High-performance laptop for AI"
    "description_vector": [0.12, -0.05, 0.44, ...],
    "brand" : "TechCorp",
    "ram_gb" : 64,
    "gpu", "v": "RTX 4090"
}
```

# Simple Pattern

```
{
    "name": "Modern Data Science Laptop",
    "description": "High-performance laptop for AI"
    "description_vector": [0.12, -0.05, 0.44, ...],
    "brand" : "TechCorp",
    "ram_gb" : 64,
    "gpu", "v": "RTX 4090"
}
```

# Attribute Pattern (Key and Value)

```
{
    "name": "Modern Data Science Laptop",
    "description": "High-performance laptop for AI"
    "description_vector": [0.12, -0.05, 0.44, ...],
    "attributes": [
        {"k": "brand", "v": "TechCorp"},
        {"k": "ram_gb", "v": 64},
        {"k": "gpu", "v": "RTX 4090"}
    ],
}
```

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# Extended Reference Pattern

# Extended Reference Pattern

```
{
   "_id": "auth123",
   "name": "Fyi",
   "expertise": "MDB"
}
```

**authors**

```
{
    "title": "Modern Document Data Modelling",
    "body": "In the era of AI, schema design is
still crucial...",
    "title_vector": [0.01, 0.22, ...],
    "author": {
        "author_id": "auth123",
        "display_name": "Fyi"
    },
}
```

**articles**

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# The Outlier Pattern

# The Outlier Pattern

**books**

```
{
  "_id": 888,
  "title": "Data Modelling for AI 2026",
  "author": "Fyi",
  "is_outlier": true, // Flag บอกว่าเป็นเอกสารขนาดใหญ่
  "summary": "This is a 1,000-page book about AI...",
  "total_chunks": 250,
}
```

**book_outliers**

```
[ {
    "book_id": 888,
    "chunk_index": 0,
    "content": "Introduction to Referencing Model...",
    "vector": [0.11, 0.22, ...], // Embedding ของเฉพาะส่วนนี้
    "page": { from: 1, to: 4 }
  },
  {
    "book_id": 888,
    "chunk_index": 1,
    "content": "Advanced Referencing Model..",
    "vector": [0.33, 0.44, ...],
    "page": { from: 5, to: 10 }
  } ]
```

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- ➢ Chat History with Bucket Pattern

# Bucket Pattern


```
{
  "_id": "session_123_bucket_1",
  "session_id": "session_123",
  "user_id": "user_456",
  "bucket_index": 1,
  "message_count": 50,
  "messages": [  ],
  "summary": "User ถามเรื่องสรุปโปรเจค MongoDB",
  "ts": "2026-01-21"
}
```

```
    {
      "role": "user",
      "content": "สวัสดีครับ ช่วยสรุปโปรเจค MongoDB ให้หน่อย",
      "ts": "2026-01-21"
    },
    {
      "role": "assistant",
      "content": "ได้เลยค่ะ โปรเจคนี้เน้นไปที่การใช้ Hybrid Search...",
      "ts": "2026-01-21",
      "tokens": 150
    }
```

# Hybrid, Vector Search Indexes & Re-ranking

- Vector Search: (k-NN, ANN, ENN)
- Hybrid Search: Full Text (BM25) + Vector Search
- Boosting Accuracy with Re-ranking (RRF)

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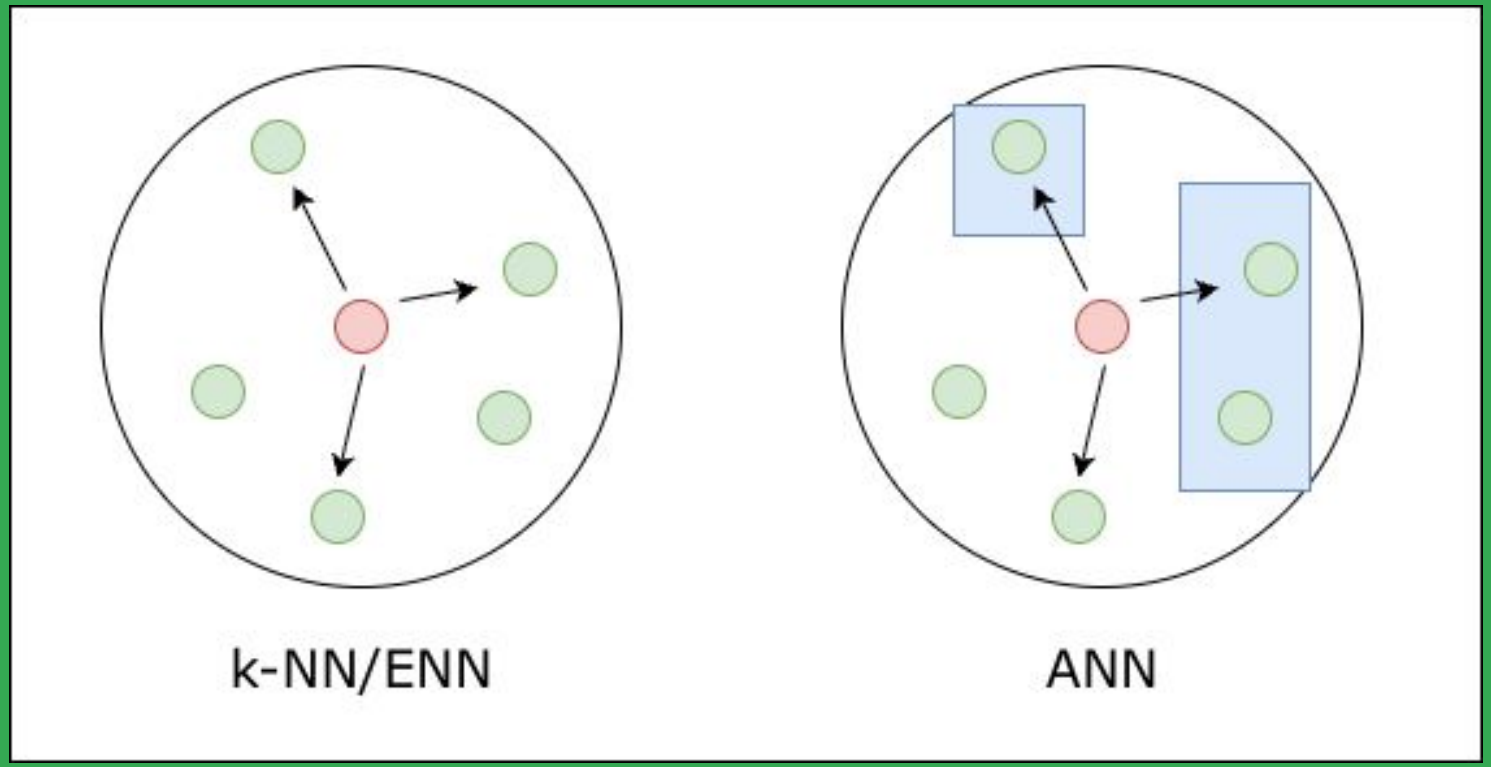
# k-NN vs ENN vs ANN : Nearest Neighbor



# k-NN vs ENN vs ANN

| คุณสมบัติ | k-NN / Exact-NN | Approximate-NN |
|---|---|---|
| ความแม่นยำ | 100% (ได้จุดที่ใกล้ที่สุดจริงๆ) | ~90-99% (มีโอกาสพลาดเล็กน้อย) |
| ความเร็ว | ช้ามาก (เมื่อข้อมูลเยอะ) | เร็วมาก (คงที่แม้ข้อมูลมหาศาล) |
| การใช้งาน | งานวิจัย, ข้อมูลขนาดเล็ก | ระบบ Search, ChatGPT, YouTube |
| เปรียบเทียบ | เดินวัดสายวัดทีละจุด | มองด้วยตาเปล่าแล้วกะระยะเอา |

# Hybrid, Vector Search Indexes & Re-ranking

- Vector Search: (k-NN, ANN, ENN)
- ➢ Hybrid Search: Full Text (BM25) + Vector Search
- Boosting Accuracy with Re-ranking (RRF)

# Hybrid Search : Full Text + Vector Search

```
{
    "title": "Modern Document Data Modelling",
    "body": "In the era of AI, schema design is still
crucial...", // Full Text Search
    "title_vector": [0.01, 0.22, ...], // Vector Search
    "author": {
        "author_id": "auth123", // Full Text Search
        "display_name": "Fyi"  // Full Text Search
    },
}
```

# Hybrid, Vector Search Indexes & Re-ranking

- Vector Search: (k-NN, ANN, ENN)
- Hybrid Search: Full Text (BM25) + Vector Search

➢ Boosting Accuracy with Re-ranking (RRF)

# Boosting Accuracy with Re-ranking (RRF)

$$RRF score(d) = \sum_{r \in R} \frac{1}{k + r(d)}$$

d คือ document

r(d) คือ rank of document ที่มาจากการค้นหา (เช่น 1, 2, 3)

k คือ ค่าคงที่ (นิยมใช้ 60)

# Boosting Accuracy with Re-ranking (RRF)

| ระบบการค้นหา | อันดับของเอกสาร A | อันดับของเอกสาร B |
|---|---|---|
| BM25 (Text) | อันดับ 1 | อันดับ 5 |
| Vector Search | อันดับ 10 | อันดับ 2 |

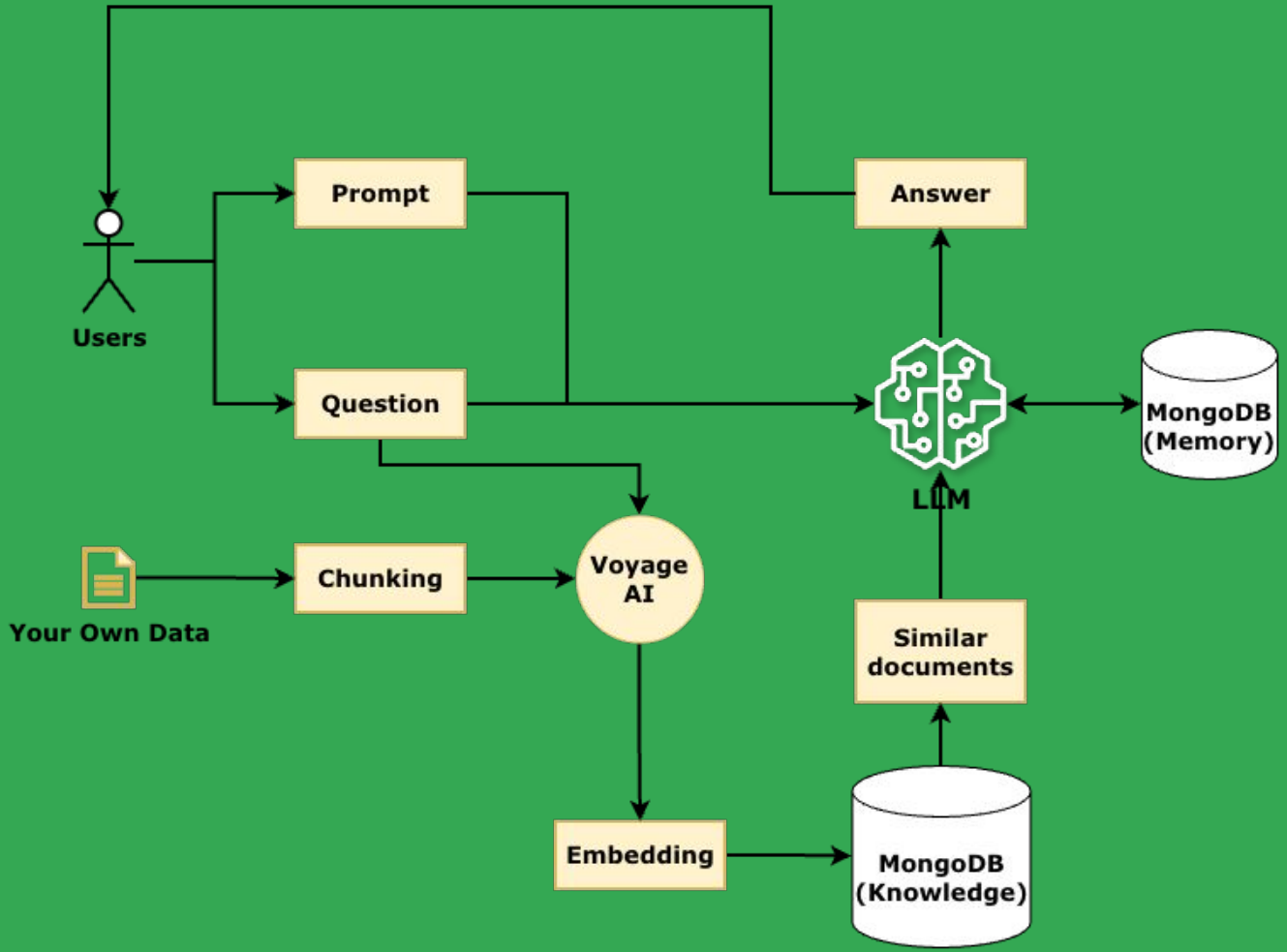
# Boosting Accuracy with Re-ranking (RRF)

**คำนวณคะแนนของเอกสาร A:**

- จาก BM25: $\frac{1}{60+1} = \frac{1}{61} \approx 0.01639$
- จาก Vector: $\frac{1}{60+10} = \frac{1}{70} \approx 0.01428$
- **คะแนนรวม A:** $0.01639 + 0.01428 = \mathbf{0.03067}$

**คำนวณคะแนนของเอกสาร B:**

- จาก BM25: $\frac{1}{60+5} = \frac{1}{65} \approx 0.01538$
- จาก Vector: $\frac{1}{60+2} = \frac{1}{62} \approx 0.01612$
- **คะแนนรวม B:** $0.01538 + 0.01612 = \mathbf{0.03150}$


Prompt
Answer
Users
Question
MongoDB
(Memory)
LLM
Chunking
Voyage
AI
Your Own Data
Similar
documents
Embedding
MongoDB
(Knowledge)

# References


- https://www.mongodb.com/docs/manual/data-modeling
- https://www.mongodb.com/docs/atlas/atlas-vector-search/vector-search-overview/

ขอบคุณครับ!!!!