

# Concept-Based RAG

Architectural Advantages for Information Retrieval

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Team *“GAN With the Wind”*

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ETH Analytics Club

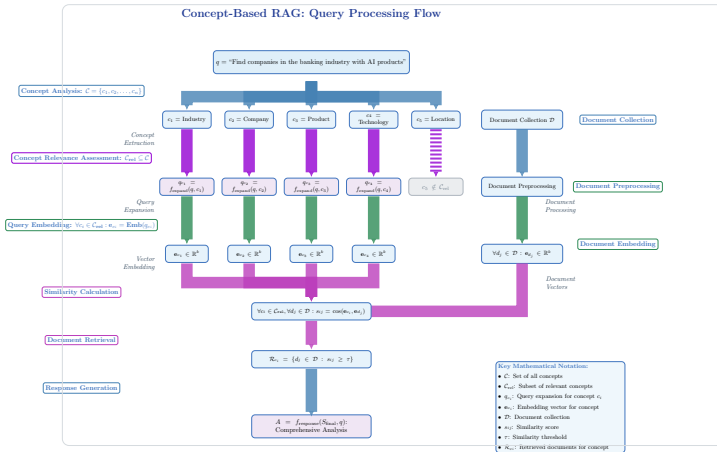
# Our Approach: Concept-Based RAG

1. Decompose query into concepts
2. Generate specialized expansions
3. Create parallel search paths
4. Filter irrelevant concepts

Multiple specialized  
vectors

=

Better information  
coverage



# Core Technical Innovation

## Query

```
"Find banking companies with  
AI products"
```

## Concept Expansion

- **Industry:** Banking sector
- **Product:** AI offerings
- **Technology:** AI applications
- Location:** Auto-removed

## Multi-Level Integration

- **Page → Company → Concept**
- Hierarchical information synthesis
- Complete attribution lineage
- Cross-concept knowledge integration

**Concept-aware information hierarchy**

# Design Principles

Traditional RAG Approach	Our Concept-Based Design
Single vector embedding	Multiple specialized vectors
May miss tangential information	Designed to capture concept-specific context
Potential limitations with complex queries	Structured for multi-dimensional questions
Constrained by similarity threshold	Aims to retrieve per-concept relevance

# Comparative Results: Traditional vs. Concept-Based RAG

## Traditional RAG: Limited information retrieval

What companies provide assisted living near Richmond, Virginia?

One of the companies that provide assisted living near Richmond, Virginia, is Covenant Woods. Covenant Woods is a not-for-profit senior living community located in Mechanicsville, just a short drive from Richmond. They offer a range of health services, including assisted living, memory support, and skilled nursing care. For more information, you can visit their website at [covenantwoods.com](https://covenantwoods.com) or contact them directly at 804.569.8000.

## Concept-Based RAG: Richer information across multiple dimensions

What companies provide assisted living near Richmond, Virginia?

Two companies provide assisted living services near Richmond, Virginia:

### 1. Covenant Woods

- Location: Mechanicsville, Virginia (near Richmond)
- Services: Independent Living, Assisted Living, Memory Support, Skilled Nursing, Therapy Services
- Address: 7090 Covenant Woods Drive, Mechanicsville, Virginia 23111
- Contact Information: General Phone: 804.569.8000, Sales Phone: 804.569.4281
- Website: [covenantwoods.com](https://covenantwoods.com)

### 2. Erickson Senior Living

- Location: Richmond, Virginia
- Services: Assisted Living as part of their continuing care retirement communities
- Website: Specific link not provided, but they operate in Richmond, Virginia.

For additional options, Virginia Health Services also provides assisted living options in Virginia, though their closest facilities mentioned are in Newport News and Yorktown, which are not immediate suburbs of Richmond. More information can be found at: [vahs.com](https://vahs.com).

# Potential Impact & Development Roadmap

## Anticipated Benefits:

- **More comprehensive answers** through multi-concept retrieval
- **Improved handling** of complex, multi-faceted queries
- **Better attribution** through structured information paths

## Future Development:

- **Personalized concept weighting** based on user models
- **Domain-specific dictionaries** for specialized fields
- **RL-optimized concept selection**

**Thank you!**