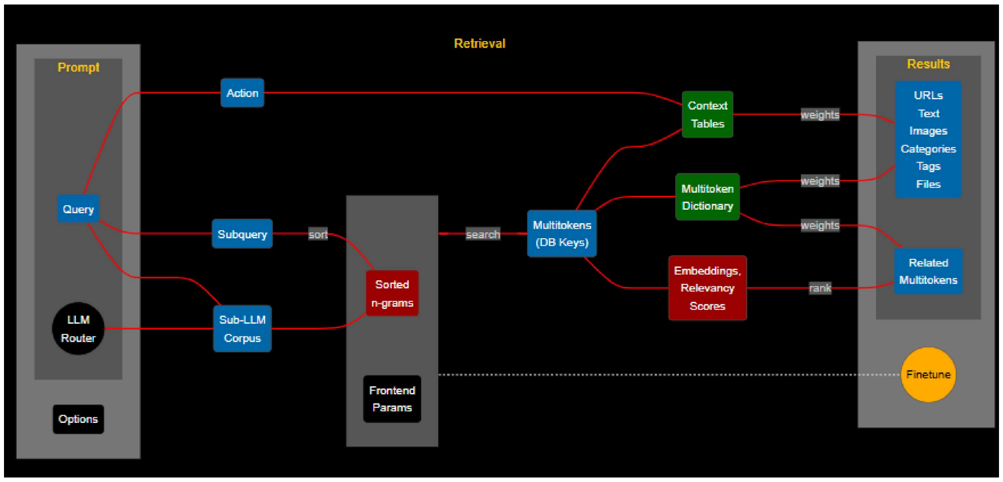
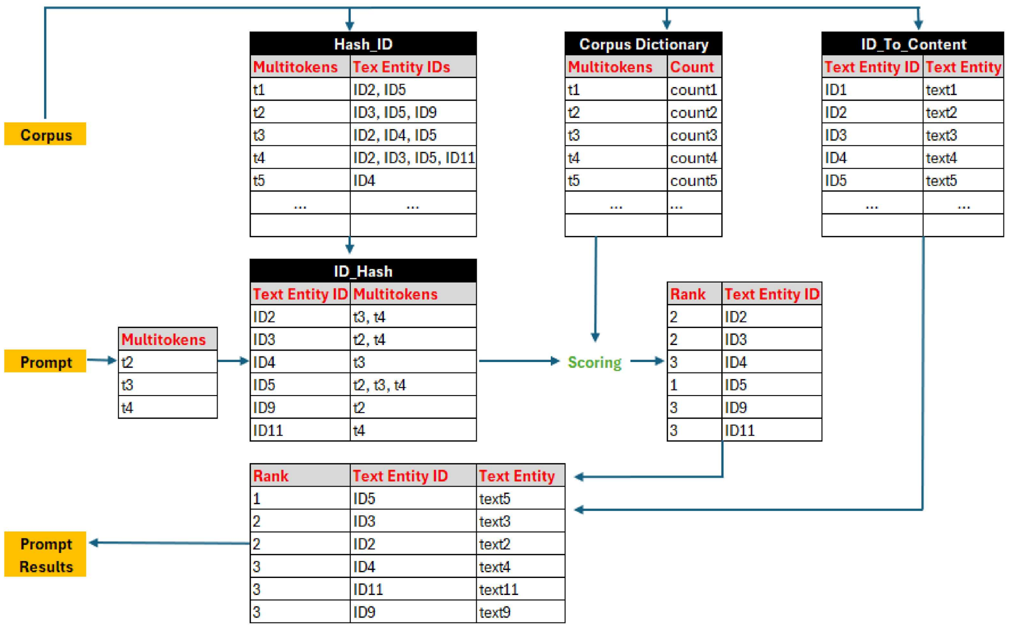
Building Disruptive AI & LLM Technology From Scratch





Hash_ID

Multitokens	Tex Entity IDs
t1	ID2, ID5
t2	ID3, ID5, ID9
t3	ID2, ID4, ID5
t4	ID2, ID3, ID5, ID11
t5	ID4
...	...

Corpus Dictionary

Multitokens	Count
t1	count1
t2	count2
t3	count3
t4	count4
t5	count5
...	...

ID_To_Content

Text Entity ID	Text Entity
ID1	text1
ID2	text2
ID3	text3
ID4	text4
ID5	text5
...	...

ID_Hash

Text Entity ID	Multitokens
ID2	t3, t4
ID3	t2, t4
ID4	t3
ID5	t2, t3, t4
ID9	t2
ID11	t4

Multitokens
t2
t3
t4

Rank	Text Entity ID
2	ID2
2	ID3
3	ID4
1	ID5
3	ID9
3	ID11

Rank	Text Entity ID	Text Entity
1	ID5	text5
2	ID3	text3
2	ID2	text2
3	ID4	text4
3	ID11	text11
3	ID9	text9

Vincent Granville, Ph.D. | www.MLTechniques.com | Version 2.0, October 2024

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Introduction

This book features new advances in game-changing AI and LLM technologies built by GenAItechLab.com. Written in simple English, it is best suited for engineers, developers, data scientists, analysts, consultants and anyone with an analytic background interested in starting a career in AI. The emphasis is on scalable enterprise solutions, easy to implement, yet outperforming vendors both in terms of speed and quality, by several orders of magnitude.

Each topic comes with GitHub links, full Python code, datasets, illustrations, and real life case studies, including from Fortune 100 company. Some of the material is presented as enterprise projects with solution, to help you build robust applications and boost your career. You don't need expansive GPU and cloud bandwidth to implement them: a standard laptop works.

Part I focuses on high performance in-memory agentic multi-LLMs for professional users and enterprise, with real-time fine-tuning, self-tuning, no weight, no training, no latency, no hallucinations, no GPU. Made from scratch, leading to replicable results, leveraging explainable AI, adopted by Fortune 100. With a focus on delivering concise, exhaustive, relevant, and in-depth search results, references, and links. See also the section on 31 features to substantially boost RAG/LLM performance.

Part II discusses related large-scale systems also benefiting from a light-weight but more efficient architecture. It features LLMs for clustering, classification, and taxonomy creation, leveraging the knowledge graphs embedded in and retrieved from the input corpus when crawling. Then, in chapters 7 and 8, I focus on tabular data synthetization, presenting techniques such as NoGAN, that significantly outperform neural networks, along with the best evaluation metric. The methodology in chapter 9 applies to most AI problems. It offers a generic tool to improve any existing architecture relying on gradient descent, such as deep neural networks.

Part III features a collection of methods that you can integrate in any AI system to boost performance. Based on a modern approach to statistical AI, they cover probabilistic vector search, sampling outside the observation range, strong random number generators, math-free gradient descent, beating the slow statistical convergence of parameter estimates dictated by the Central Limit Theorem, exact geospatial interpolation for non-smooth systems, and more. Efficient chunking and indexing for LLMs is the topic of chapter 10. Finally, chapter 15 shows how to optimize trading strategies to consistently outperform the stock market.

About the author

Vincent Granville is a pioneering GenAI scientist and machine learning expert, co-founder of Data Science Central (acquired by a publicly traded company in 2020), Chief AI Scientist at MLTechniques.com, former VC-funded executive, author and patent owner – one related to LLM. Vincent's past corporate experience includes Visa, Wells Fargo, eBay, NBC, Microsoft, and CNET.

Vincent is also a former post-doc at Cambridge University, and the National Institute of Statistical Sciences (NISS). He published in *Journal of Number Theory*, *Journal of the Royal Statistical Society* (Series B), and *IEEE Transactions on Pattern Analysis and Machine Intelligence*. He is the author of multiple books, available here, including "Synthetic Data and Generative AI" (Elsevier, 2024). Vincent lives in Washington state, and enjoys doing research on stochastic processes, dynamical systems, experimental math and probabilistic number theory.

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