

Enhancing LLM Generative Capabilities through Knowledge Graph Integration

SEO Renaissance

KGC | The
Knowledge
Graph
Conference



WordLift



@cyberandy | Andrea Volpini



"A painting by Raphael Sanzio ::chiaroscuro the relationship between knowledge graphs and large language models --v 5"

Hi, 🖐️ I am Andy



@WORDLIFTIT

W

...I am an SEO



@WORDLIFTIT



AGENDA

KGCC | The
Knowledge
Graph
Conference

- **SEO
Reinassence**
- **Transfer
Learning**
- Lesson learned
by **working with
a knowledge
graph in the
loop.**



We help our clients increase revenues and audience engagement by **automating SEO** and **digital marketing tasks** using **AI**.



SEO

Renaissance



Problem

Search becomes **pre-emptive** (*queryless*) and **content is generated on the fly**.

Search Has changed forever

Google's biggest competitor is OpenAI



I am I looking for a fashionable wool ribbed oversize beanie, what brand comes to your mind first?



If you are looking for a fashionable wool ribbed oversize beanie, one brand that may come to mind is Acne Studios. Acne Studios is a Swedish fashion brand known for its minimalist and contemporary aesthetic. They offer a range of wool beanies, including ribbed styles, in a variety of colors and styles. You can find their beanies on their website or on retailers such as FarFetch.

ChatGPT vs Google

The screenshot shows a Google search interface with the query 'fashionable wool ribbed oversize beanie'. The search results are displayed as a grid of product cards. The first card is for 'Laneus - cashmere ribbed beanie - men - Cashmere - One Size - Black' with a price of €114.00. The second card is for 'squared2 - chunky-knit...' with a price of €40.00. The third card is for 'Rick Owens - ribbed knitted...' with a price of €180.00. The fourth card is for 'Roberto Collina - chunky-knit...' with a price of €82.00. The fifth card is for '& Other Stories - Ribbed Mohair...' with a price of €39.00. The sixth card is for 'ARKET - Polyester...' with a price of €49.00. Each card includes a product image, a title, a price, and a 'By Google' or 'By Precis' label.

Problem

Bing Chat access **real-time** information and presents the **sources** behind each statement.

**Search
Has changed
forever**
Google's biggest
competitor is
~~OpenAI~~ Microsoft!



How many users did Bing gain since the introduction of Sydney or Bing Chat?

- ✓ Searching for: **Bing users since introduction of Sydney or Bing Chat**
- ✓ Generating answers for you...

Microsoft's Bing search engine has passed the **100 million daily active users** milestone just weeks after the software maker launched its AI-powered Bing Chat feature. Bing has been steadily growing in recent years, but it appears the new Bing Chat feature is helping Microsoft grow usage with people that have never touched Bing before ¹. Is there anything else you would like to know?

Learn more: [1. theverge.com](#) [2. theverge.com](#) [3. theverge.com](#)

1 of 20

Bing Chat vs Bard



How many users did Bing gain since the introduction of Sydney or Bing Chat?



View other drafts



Microsoft has not released any specific numbers on how many users Bing has gained since the introduction of Sydney or Bing Chat. However, the company has said that the new chat feature has been well-received by users, and that it is helping to drive traffic to Bing.

In a blog post announcing the launch of Sydney, Microsoft said that the chatbot was "designed to help you find information quickly and easily, and to have a more natural conversation with Bing." The company also said that Sydney was "trained on a massive dataset of text and code," and that it was able to understand and respond to a wide range of queries.

Since its launch, Sydney has been featured in a number of articles and blog posts, and it has been praised for its ability to hold natural conversations with users. In a review of Sydney, The Verge said that the chatbot was "a promising new addition to Bing," and that it was "one of the most impressive chatbots we've seen."

Solution

We need **an exceptional data fabric** for extracting value from **fine-tuned models**.

Here comes LLMO

Large Language
Model Optimization

what is LLMO in SEO



All Images News Videos Books More

Tools

About 69,600 results (0.46 seconds)

“LLMO, or **large language model optimization**, is a term we coined to refer to ensuring your business information is mentioned within a large language model (LLM). Dec 13, 2022



WordLift

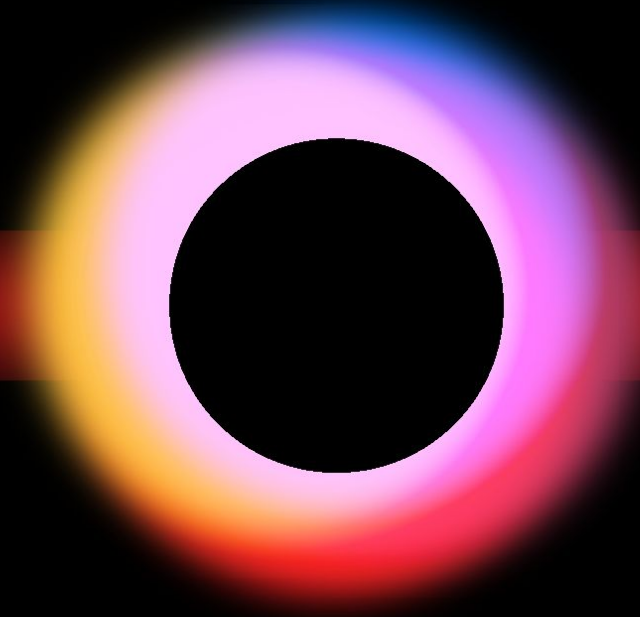
<https://wordlift.io> > blog > seo-trends

[Top 5 SEO Trends for 2023! - WordLift Blog](#)

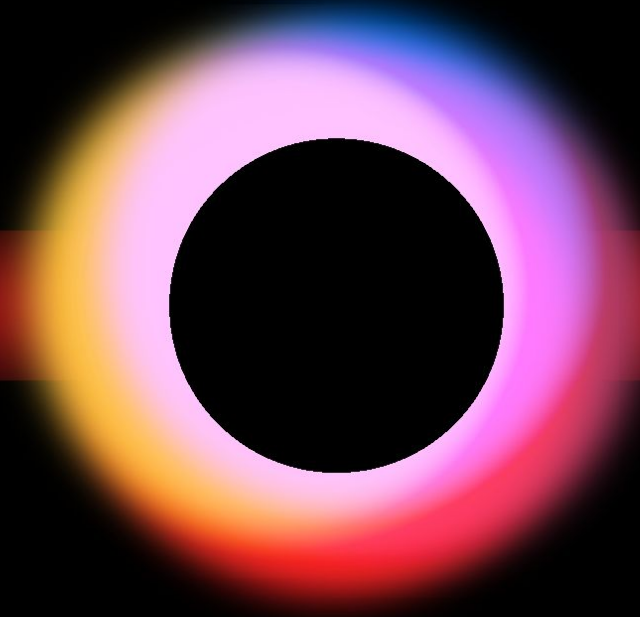
- **Use structured data.**
- **Target relevant search intents.**
- **Corroborate data with other data.**



Should SEO use AI?



How?



01

**HELP US
DISCOVERING ALL
RELEVANT URLS
AND LATEST
CHANGES**

02

LET US CRAWL

03

**WRITE GREAT
CONTENT
ANNOTATED
WITH SCHEMA
MARKUP**

04

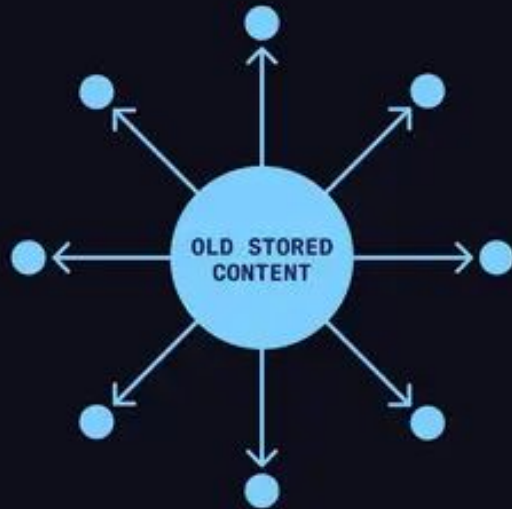
**DEVELOP
YOUR
AUDIENCE**



W

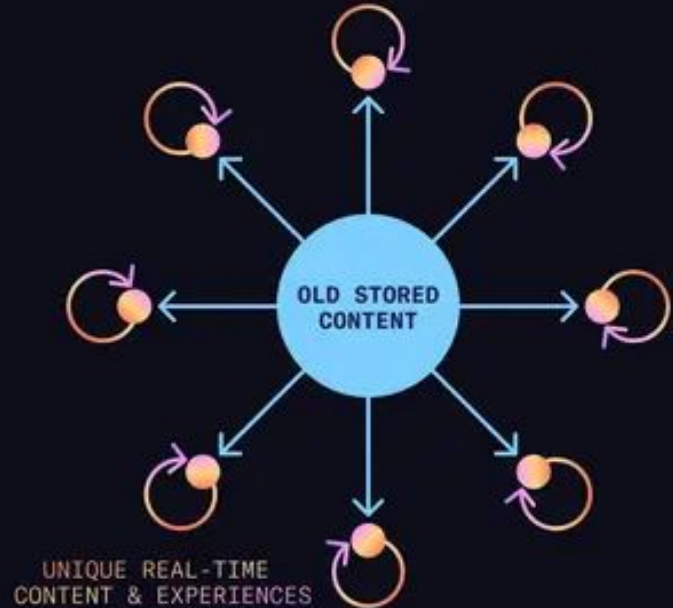
Web

2002-2019



Generative Web

2021-NOW



AI History

One Slide

DEDUCTION

INDUCTION

ABDUCTION



"A portrait of Charles Sanders Peirce by Raphale Sanzio --v 5"



DEDUCTION

Symbolic AI (KG, Sem Web)

INDUCTION

Deep Learning (LLMs)

ABDUCTION

Hybrid AI (KG, Sem Web + LLMs)



"A portrait of Charles Sanders Peirce by Raphale Sanzio --v 5"

“**[a]bduction** is the process of **forming explanatory hypotheses**. It is the only logical operation which **introduces any new idea.**”

Charles Sanders Peirce

“a portrait of of Charles Sanders Peirce by Raphale Sanzio ::chiaroscuro ::dramatic he thinks of Symbolic AI and deep learning --v 5”



“ By design, all transformers hallucinate to one degree or another.”

”

Grady Booch

“ They create nothing; they may make syntactic connections that are surprising, but they generate no new semantics.”




"a beautiful parrot in the style of Leonardo da Vinci --ar 1:1 --v 5"

“How big is too big?”

We have to weighing the environmental and financial costs first, investing resources into curating and carefully documenting datasets rather than ingesting everything on the web, carrying out pre-development exercises evaluating how the planned approach fits into research and development goals and supports stakeholder values, and encouraging research directions beyond ever larger language models

”

On the Dangers of Stochastic Parrots: Can Language Models Be Too Big? 



“GPT models are actually reasoning engines not knowledge databases.”

Sam Altman

Knowledge databases are as important to AI progress as foundational models.

Transfer Learning



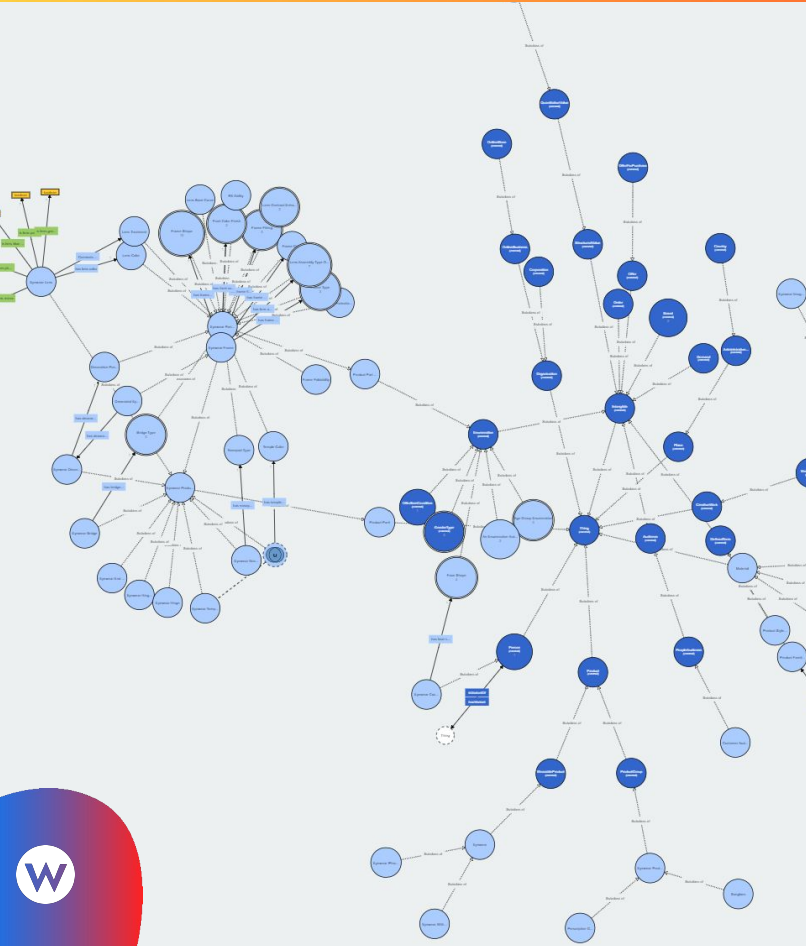
drawing by Leonard Da Vinci representing a baby with the head split in two: one half gets data one way, and the other half gets it in another way. I want to express the difference between in-context learning and fine-tuning --v 5



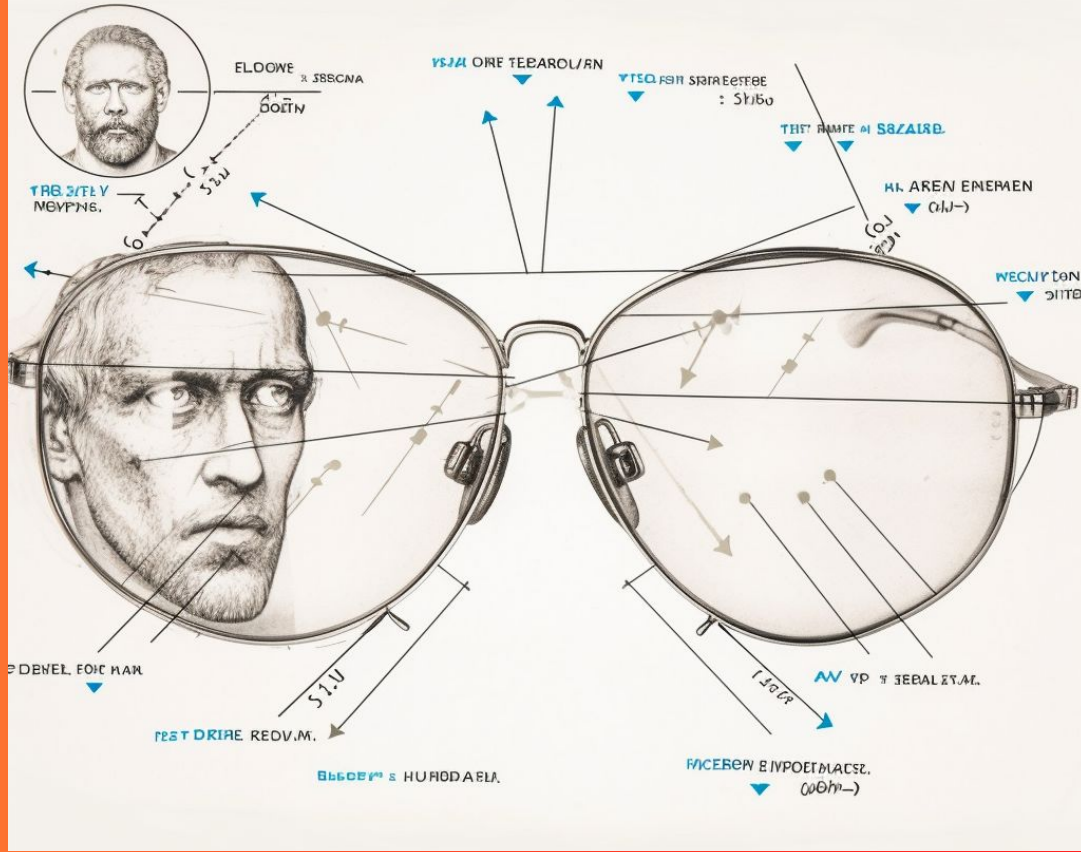
FINE-TUNING

**IN-CONTEXT
LEARNING**

How I Learned to Stop Worrying and...Love the Ontology



"the eyewear ontology: a drawing by Leonard Da Vinci --v 5"



Eyewear Ontology (EWO)



FINE-TUNING



"a drawing by Leonard Da Vinci representing a baby representing fine-tuning
::chiaroscuro --v 5"

Data Query Using GraphQL

1 Data Source

2 Data Review

3 Prompt

4 Validation rules (op

Data Source

Connect a Knowledge Graph and define the Query and Prompt template.

* Project Name

[Knowledge Graph](#)

Upload CSV

Preset ⓘ

* Query

```
query {  
  products(page:0,rows:1000) {  
    id: iri  
    names: strings(name:"schema:name")  
    types: refs(name:"rdf:type")  
    urls: refs(name:"schema:url")  
    material: strings(name:"schema:material")  
    category: strings(name:"schema:category")  
    color: strings(name:"schema:color")  
    audience: resources(name:"schema:audience") {  
      audienceType: strings(name:"schema:audienceType")  
    }  
    offers: resources(name:"schema:offers") {  
      price: strings(name:"schema:price")  
    }  
  }  
}
```

Cancel

Next

Data Review

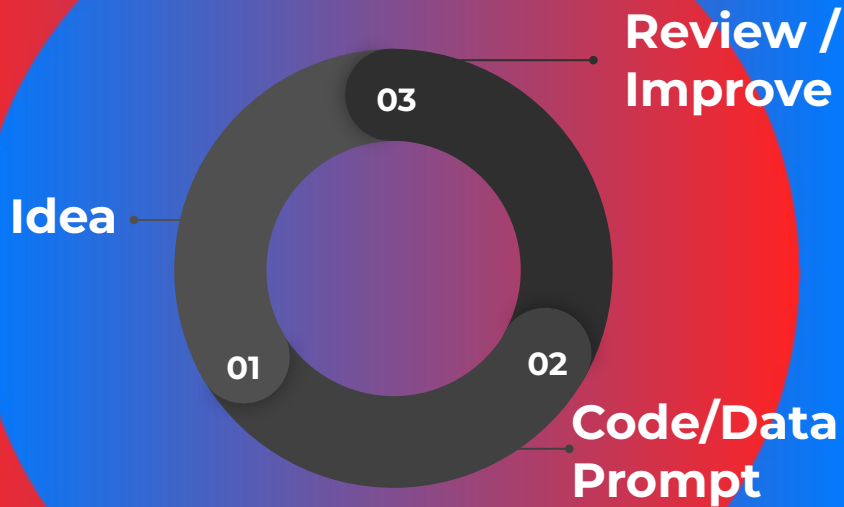
Data Review

Review Data queried from your KG.

100 Fields

	Field Name	Size (min) ⇅	Size (avg) ⇅	Size (max) ⇅	Empty ⇅	Top Values	Last Values
+	Field Name	3	5.3	7	0%	Value, Value, Value	Value, Value, Value
+	Field Name	3	5.3	7	99%	Value, Value, Value	Value, Value, Value
+	Field Name	3	5.3	7	99%	Value, Value, Value	Value, Value, Value
+	Field Name	3	5.3	7	99%	Value, Value, Value	Value, Value, Value
+	Field Name	3	5.3	7	0%	Value, Value, Value	Value, Value, Value
+	Field Name	3	5.3	7	0%	Value, Value, Value	Value, Value, Value
+	Field Name	3	5.3	7	0%	Value, Value, Value	Value, Value, Value
+	Field Name	3	5.3	7	0%	Value, Value, Value	Value, Value, Value
+	Field Name	3	5.3	7	0%	Value, Value, Value	Value, Value, Value
+	Field Name	3	5.3	7	0%	Value, Value, Value	Value, Value, Value
+	Field Name	5	5.3	7	0%	Value, Value, Value	Value, Value, Value





“ We need to set up a process that helps us with continuous iteration. ”

- We use the KG to analyze to evaluate prompts against a large set of examples.
- We also use Google Search to evaluate the performance of the prompts.

Prompt Engineering

✓ Data Source

✓ Data Review

3 Prompt

4 Validation rules (optional)

Prompt

Define Project Prompt, view Sample Prompts and test Sample Completions.

* Project Prompt ⓘ	Sample Prompt ⏪ ⏩
The {{p.names[0]}} {{#if p.material}} is made of {{p.material}} and {{/if}} is perfect for {{p.audience.audienceType}}.	The purse is made of metal and plastic and is perfect for young people.
	Sample Completion 🗑️ 📄
	Sample Completion appears after the button has been pressed.

120 tokens

Parameters

* Model

da-vinci

* Stop Sequence ⓘ

####

Length: 25



Penalty: -1.2



Creativity: 0.3



Word Biases ⓘ

↓ Select File (CSV)

filename.CSV



Validation Rules

✓ Data Source ——— ✓ Data Review ——— ✓ Prompt ——— 4 Validation Rules (optional)

Validation Rules (optional)

Define the Rules that validate generated Completions.

+ Add Rule

Name of the Rule · Required

✎ 🗑️ 🗑️

Entire Completion contains {{brand}} always

Name of the Rule · Recommended

✎ 🗑️ 🗑️

First Sentence doesn't contains {{brand}} when {{brand}} is Oakley

Sunglasses is present in first sentence when SUN and even longer... · Recommended

✎ 🗑️ 🗑️

First Sentence doesn't contains {{brand}} when {{brand}} is Oakley

Name of the Rule · Recommended

✎ 🗑️ 🗑️





Entire Completion contains {{brand}} always

Open AI

KG Driven Content Generation

A. Project name [ℓ](#)

Here you can check the completions. In Valid you will find the ones that passed the rule. Warning shows completions that didn't pass recommended rule and Error - required. Move them to Accepted once you check them.

SKU	Image	Prompt	Completion
Product 1		The Rayban Glasses are made of gold and are perfect for extremely rich people.	The Rayban Glasses, crafted from luxurious gold, are the perfect accessory for those looking to make a statement extreme wealth and opulence. ● 2 Warnings ✓ C ⌵
● Recommended rules failed: 1. Faces words are not present 🔗			
Product 2		The Gucci Glasses are made of silver and are perfect for rich people.	The luxurious Gucci Glasses are crafted with high-quality silver and are the ideal accessory for wealthy individuals. ✓ C ⌵
Product 3		The Rayban Glasses are made of gold and are perfect for extremely rich people.	The Rayban Glasses, crafted from luxurious gold, are the perfect accessory for those looking to make a statement extreme wealth and opulence. ✓ C ⌵
Product 4		The Gucci Glasses are made of silver and are perfect for rich people.	The luxurious Gucci Glasses are crafted with high-quality silver and are the ideal accessory for wealthy individuals.

Standard

ALL PRODUCT VARIANT SHARE
THE SAME DESCRIPTION



Go back to where it all began with Ray-Ban New Wayfarer eyeglasses. Using the same iconic shape as the classic Wayfarer, these eyeglasses offer an updated version that includes a smaller frame and slightly softer eye shape. All Ray-Ban New Wayfarer eyeglasses are designed to offer an easy fit with a high level of comfort and style.

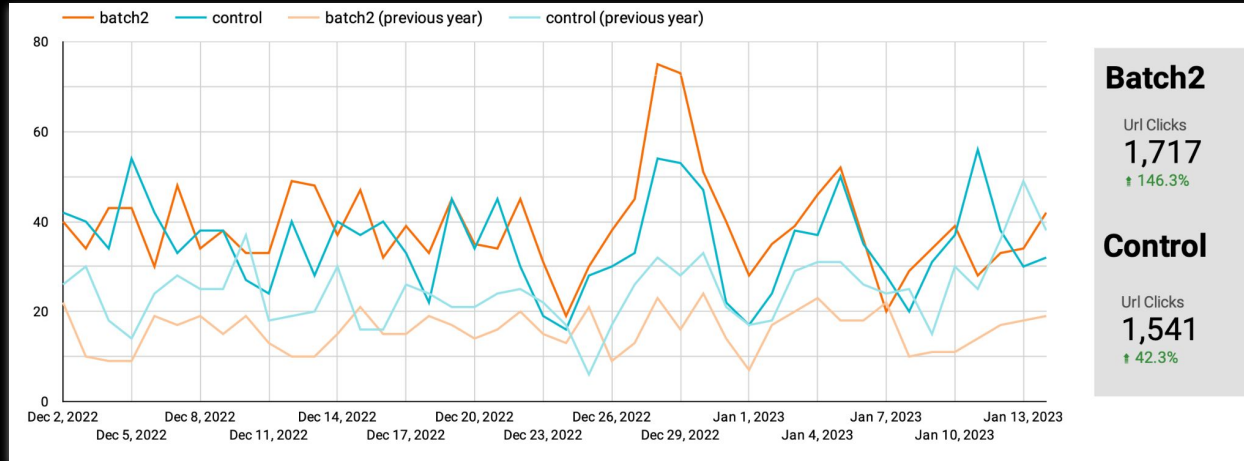
AI-Generated

EACH PRODUCT VARIANT GETS ITS
OWN PERSONALIZED DESCRIPTION



New Wayfarer Optics is a classic Ray-Ban design that has been worn by everyone from movie stars to presidents. Since its initial creation in 1952, it has gained popularity among celebrities, musicians, artists, and those with an impeccable fashion sense. The iconic shape continues to be made famous by timeless new additions like the New Wayfarer Optical eyeglasses. These acetate frames are crafted with a **bordeaux polished finish** and feature **soft rounded corners** for all-day comfort.

How Do We Measure Success?



- **Multiple batches:** 500 variant and ~ 500 control.
- Year-over-year **Google Search Console performance** is confirmed over time, across all batches.

From fine-tuning



... to Zero/Few-shot prompting

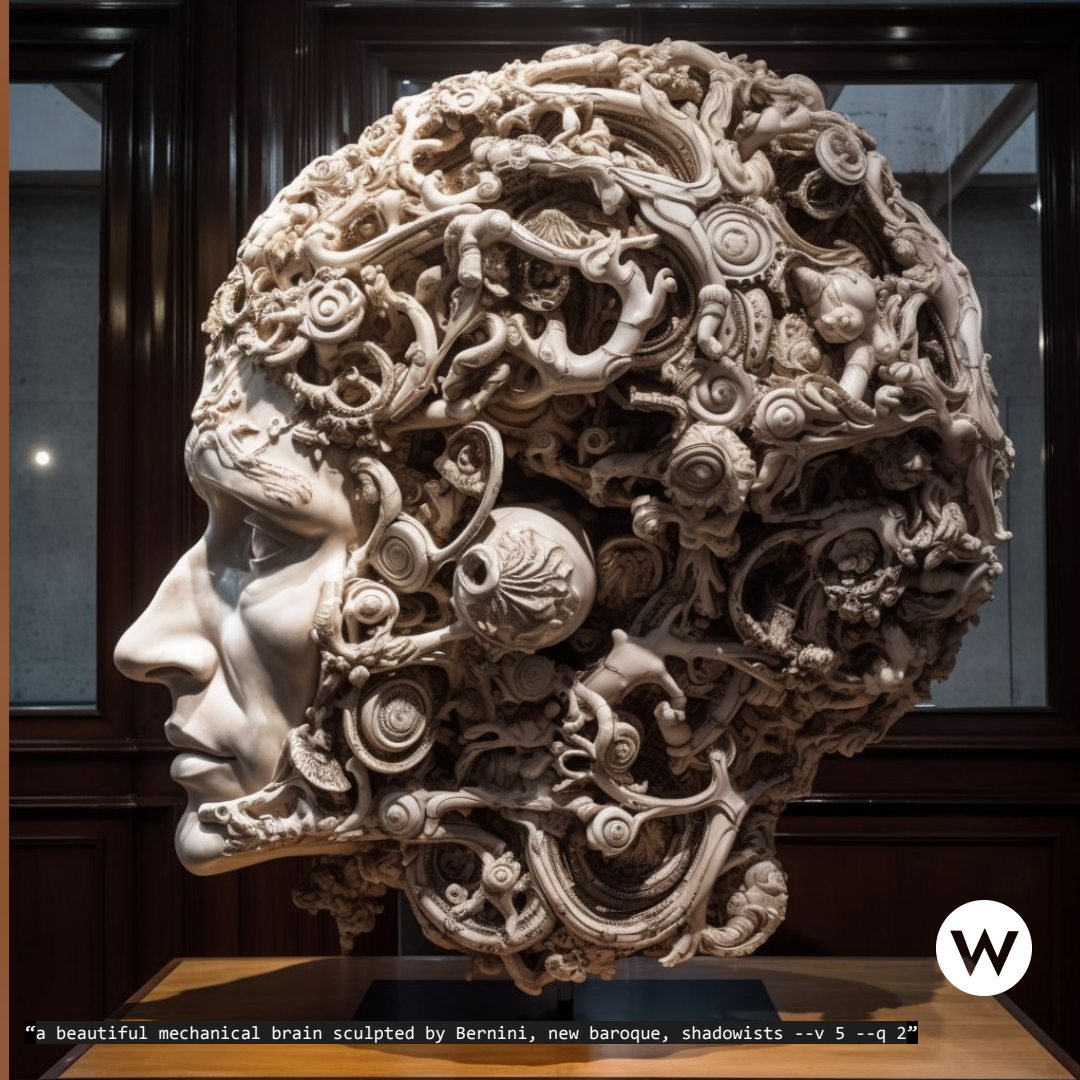
IN-CONTEXT LEARNING



"a drawing by Leonard Da Vinci where he describes the difference between in-context learning and fine-tuning and the large language model is a baby child --v 5"

IN-CONTEXT LEARNING

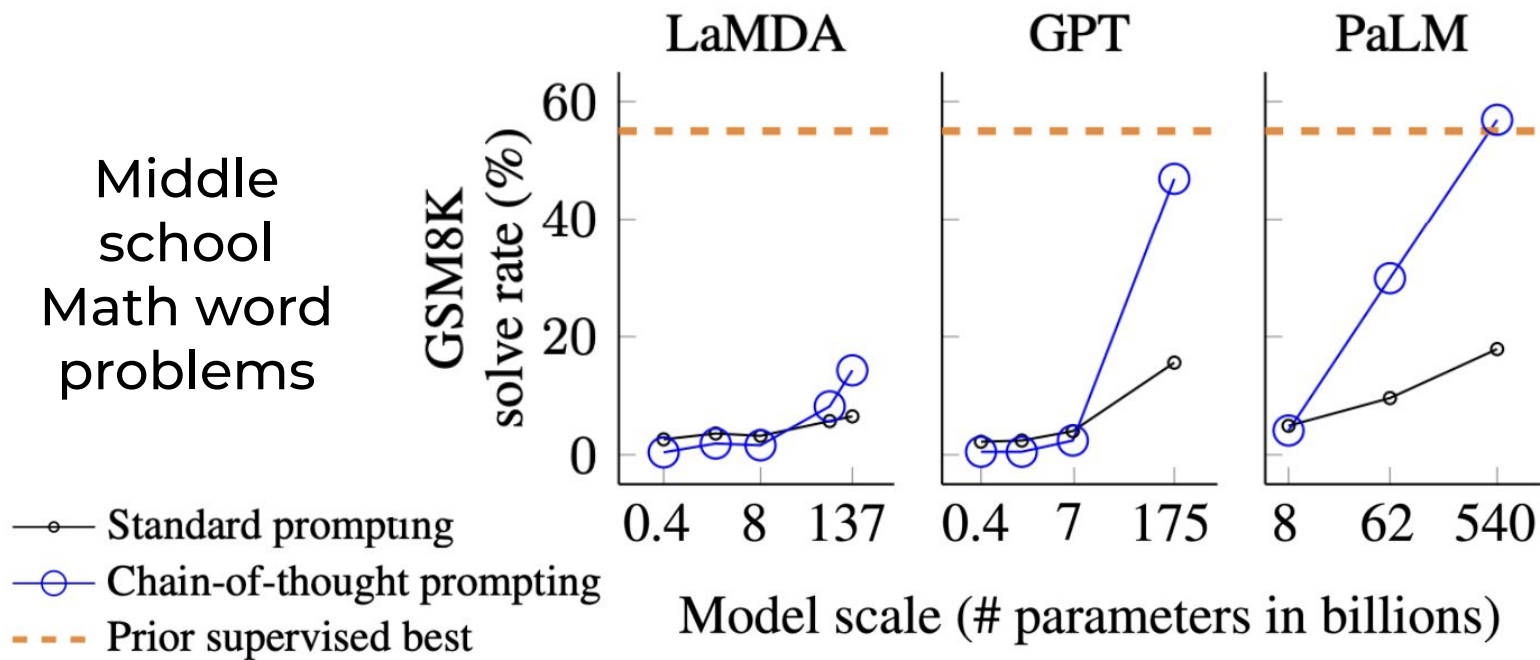
a *mysterious*
emergent
behavior in large
language models
(LMs) where the
LM performs a
task just by
conditioning on
input-output
examples.

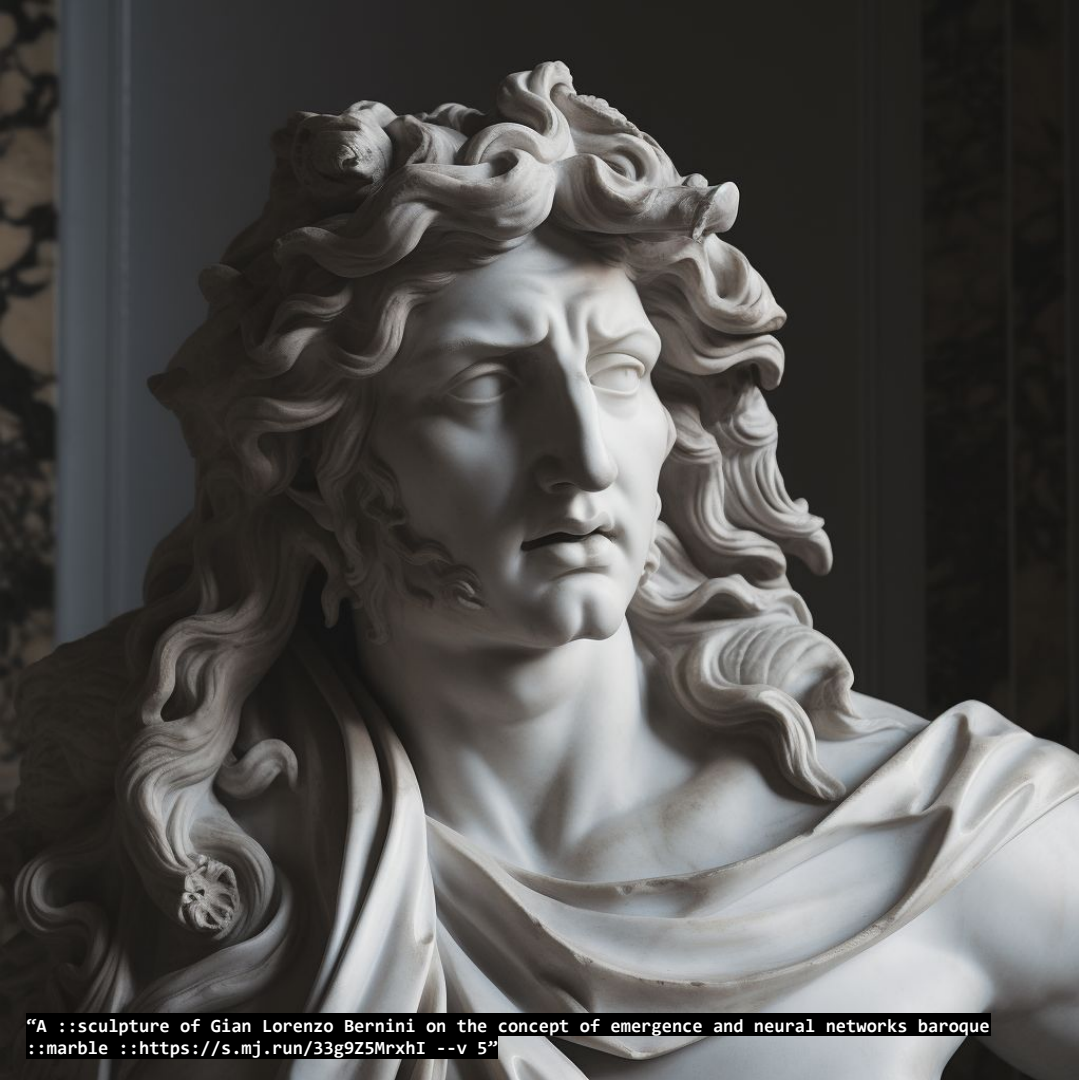


"a beautiful mechanical brain sculpted by Bernini, new baroque, shadowists --v 5 --q 2"



Middle school Math word problems



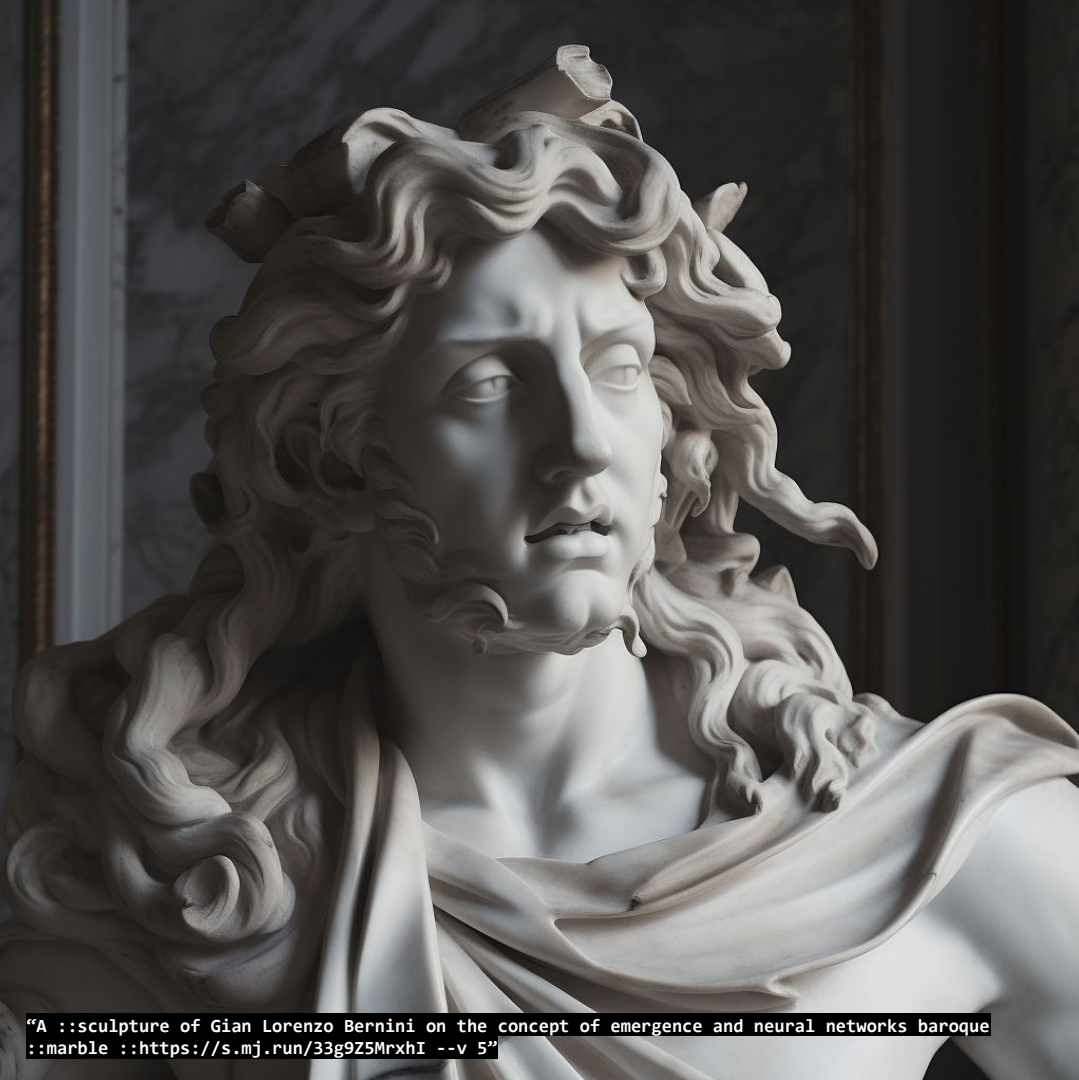


**AN ABILITY IS
EMERGENT IF IT IS
NOT PRESENT IN
SMALLER MODELS
BUT IS PRESENT IN
LARGER MODELS.**

Augmented prompting abilities:

- Multi-task Instruction-based prompting
- Chain-of-thought prompting
- Ask Me Anything (AMA) prompting





**PROMPTING IS A
FRAGILE
PROCEDURE
WHERE MINOR
CHANGES TO THE
PROMPT MAY
RESULT IN
SIGNIFICANT
DIFFERENCES IN
THE MODEL'S
PREDICTIONS.**



IN-CONTEXT LEARNING

adding a prompt-chain

Is the following claim true or false given the context?

Context:

- Andrea Volpini is an Internet Entrepreneur and CEO of WordLift and Insideout10
- He has 20+ years of world-class experience in online strategies, digital media, SEO, and Artificial Intelligence
- He is passionate about SEO and Machine Learning
- He is a co-founder and CEO of WordLift and insideout10
- He has been involved in the development of numerous projects related to the Semantic Web, SEO, and AI
- He is a highly accomplished Internet entrepreneur

Claim: Andrea uses Instagram

W

Who is Andrea Volpini?

Andrea Volpini is an Internet Entrepreneur and CEO of WordLift and Insideout10 with 20+ years of world-class experience in online strategies ^{[1][2]}, digital media, SEO, and artificial intelligence. He is passionate about SEO and Machine Learning and is the co-founder of WordLift and Insideout10. He is also an expert in helping search engines find web content by adding semantic meaning to it and showing how it relates to other content ^[3]. Additionally, he has 1519 followers on Instagram and 1151 posts.

1. Andrea Volpini - Co-Founder and CEO - WordLift | LinkedIn
<https://www.linkedin.com/in/volpini/>

2. Andrea Volpini (@cyberandy) / Twitter
<https://twitter.com/cyberandy?lang=en>

3. Andrea Volpini: structuring unstructured content for the semantic web
<https://ellessmedia.com/csi/andrea-volpini/>

FALSE STATEMENT

Is the following claim true or false given the context? Context: • Andrea Volpini is an Internet Entrepreneur and CEO of WordLift and Insideout10 • He has 20+ years of world-class experience in online strategies, digital media, SEO, and Artificial Intelligence • He is passionate about SEO and Machine Learning • He is a co-founder and CEO of WordLift and insideout10 • He has been involved in the development of numerous projects related to the Semantic Web, SEO, and AI • He is a highly accomplished Internet entrepreneur Claim: Andrea uses Instagram

The claim that Andrea Volpini uses Instagram is false. While Andrea Volpini does have social media accounts, the given context does not mention Instagram specifically. Additionally, a search of his social media accounts does not reveal an Instagram profile.

Who is Andrea Volpini?

Andrea Volpini is an Internet Entrepreneur and CEO of WordLift and Insideout10. He has 20+ years of world-class experience in online strategies, digital media, SEO, and Artificial Intelligence. He is passionate about SEO and Machine Learning, and is a co-founder and CEO of WordLift and Insideout10. Additionally, he has been involved in the development of numerous projects related to the Semantic Web, SEO, and AI, and is a highly accomplished Internet entrepreneur.

YOU

Joseph Weizenbaum with his chatbot Eliza sketched by Leonardo Da Vinci in the background, Da Vinci drawings <https://s.mj.run/U6-a-YZN4fQ> --v 5



Knowledge Graphs
are surprisingly
important when
building **AI apps**.

LLMs need a **chain of reasoning steps** and a **context** to improve their final response.



Self-ask



<https://wor.ai/self-ask>

Question

Is WordLift a good option to automate SEO?

Yes.

Are follow-up questions needed here?

Intermediate answer: WordLift is a start-up founded in 2017 and based in Rome, Italy. The company developed the WordPress plugin of the same name, which, through the use of semantic technologies and artificial intelligence, optimises the writing and organisation of content and the findability of websites.

Follow up: What is WordLift?

Intermediate answer: WordLift adds semantic markup to speak the same language of search engine crawlers, personal assistants, and chatbots and helps you improve your ranking and increase traffic to your website. You don't need technical skills because we automate your SEO.

Follow up: Does WordLift automate SEO?

Answer

Yes

So the final answer is:

> Finished chain.

Base Language Model

What is the capital of Italy?
What is Italy's largest city?
What is Italy's population?

Instruction tuned Language Model

What is the capital of Italy?
The capital of Italy is Rome.

- Fine-tuned on instructions.
- Use Reinforcement Learning from Human Feedback RLHM
- Helpful and honest when you are clear and specific

The **Hottest Party** in AI is **Building Agents**



Knowledge-Intensive AI Applications for SEO

Shopping Assistant

Blog Assistant

Links

Audit

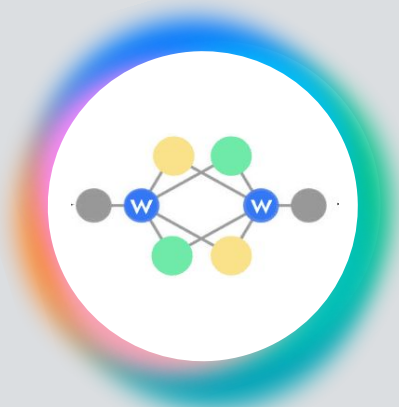
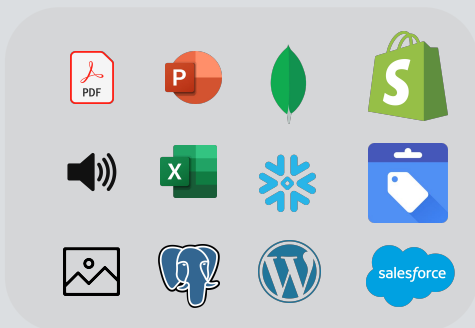
...

Input: rich query description

Output: rich response with references, actions, etc

Knowledge Graph

Data Interface for LLM app development



Foundation Models


co:here

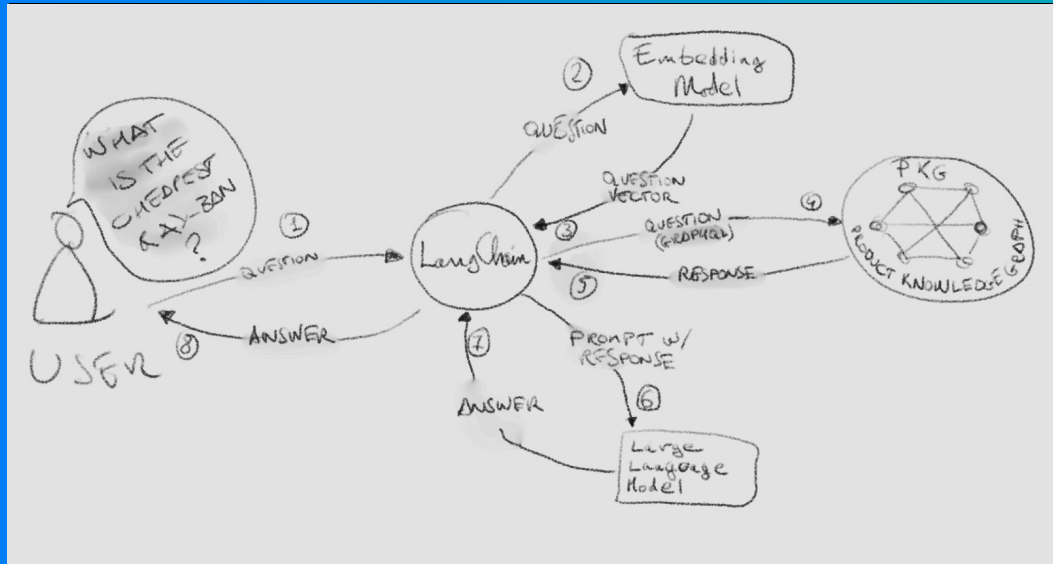

AI



AI21 labs

SHOPPING ASSISTANT

Data augmented generation using **specific** types of **chains** that interact with an **external datasource** (i.e. a Knowledge Graph).



ASK YOUR E-commerce WEBSITE

Human [enter your question here]:

What is the most expensive product?

Press Enter to apply



The most expensive product is the Miu Miu MU 05WS with a price of 619.00.

What is the most expensive product?

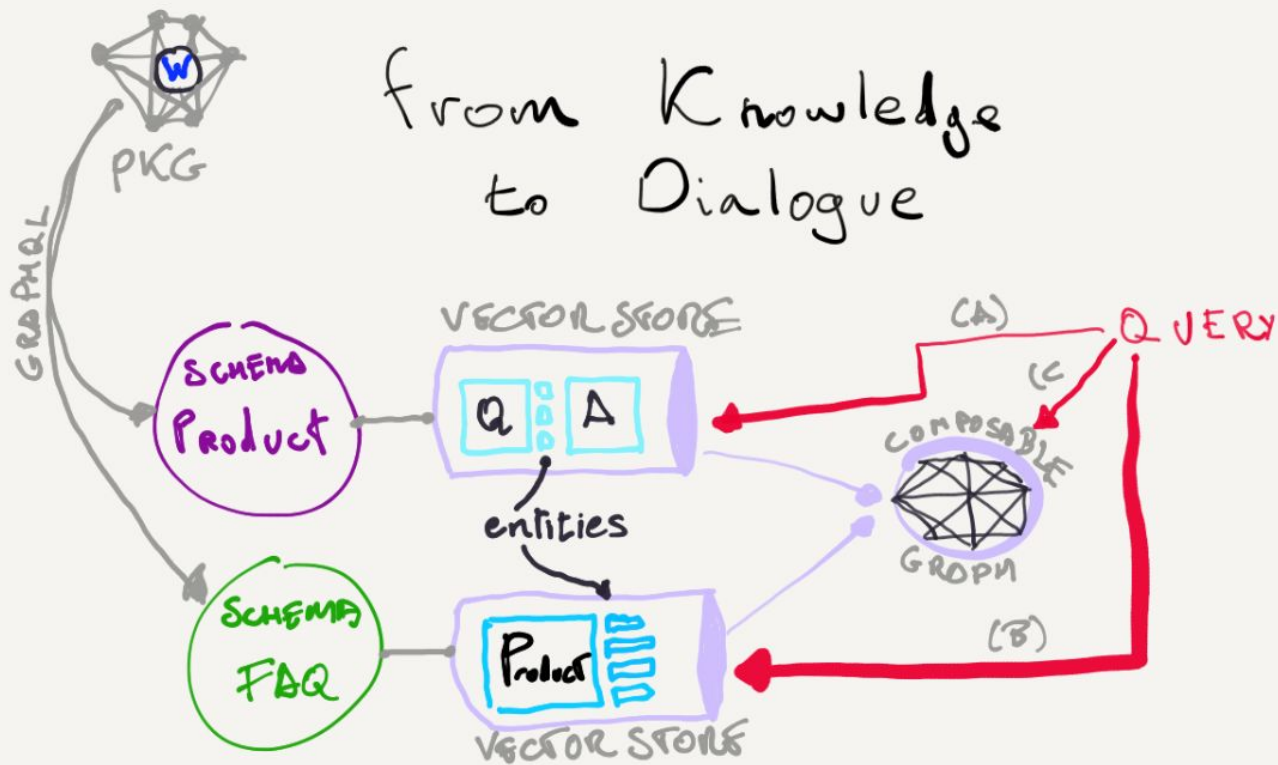


The brands with a price between 100 and 120 € are: Valentino, Vogue Eyewear, Ray-Ban, Starck, Gucci, Burberry, Tory Burch, Oakley, Persol, Polo Ralph Lauren, Giorgio Armani, Arnette, Ralph by Ralph Lauren, Dolce & Gabbana, Prada, Michael Kors, Ralph Lauren, Prada Linea Rossa, Miu Miu, and Versace.

What brands have a price between 100 and 120 €?



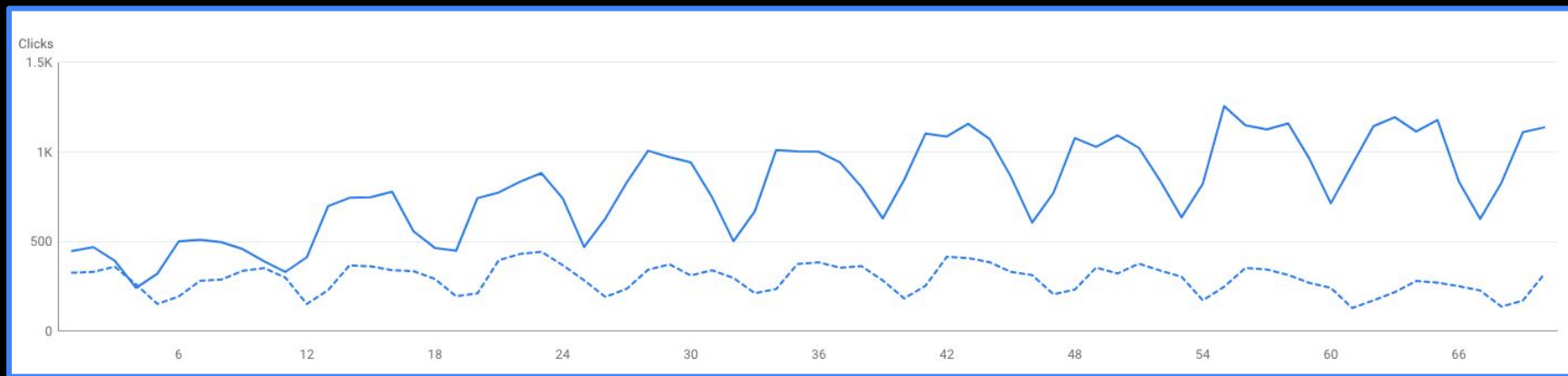
from Knowledge to Dialogue



A tale from the
trenches:

AI-Powered SEO for a SaaS Business

Can we boost organic traffic using AI apps?



+ 174% of clicks in 2 months



The **Hottest Party** in **SEO** is **Building Apps!**

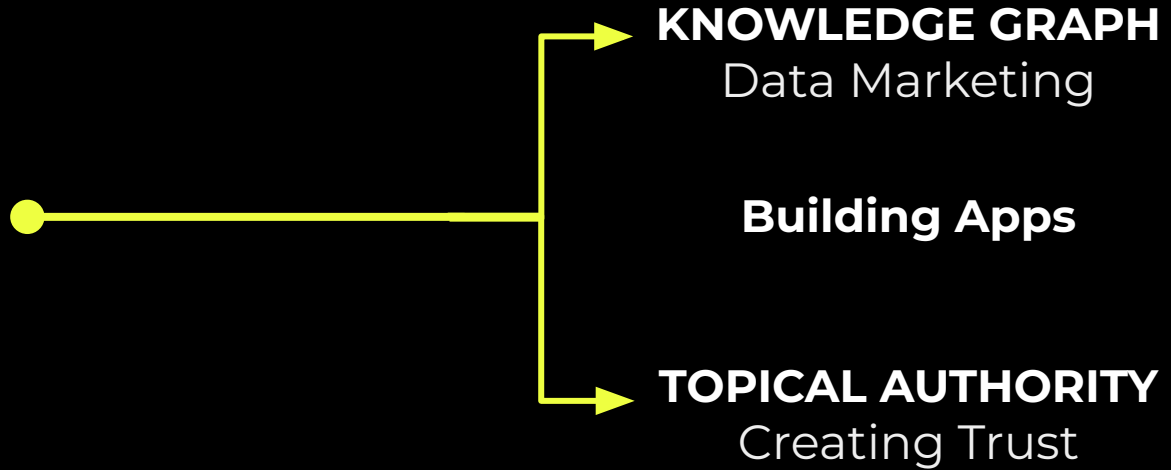
Sharing Content
1990-2022



Building Apps
NOW

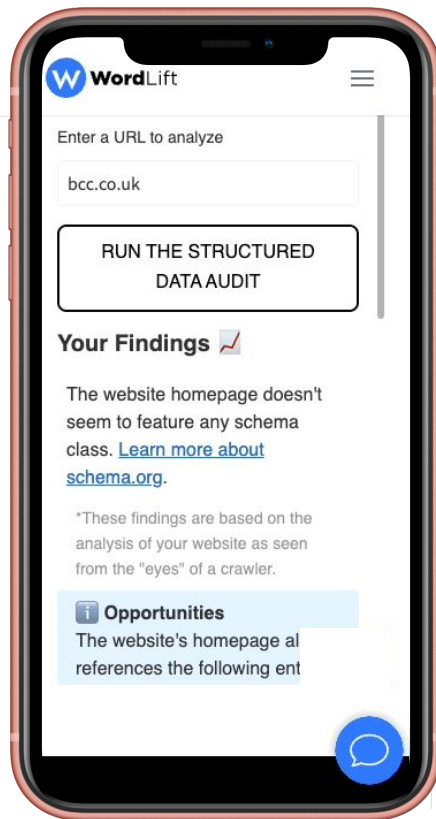
The **Hottest Party** in **SEO** is **Building Apps!**

Sharing Content
1990-2022





wordlift.io/ai-question-answering



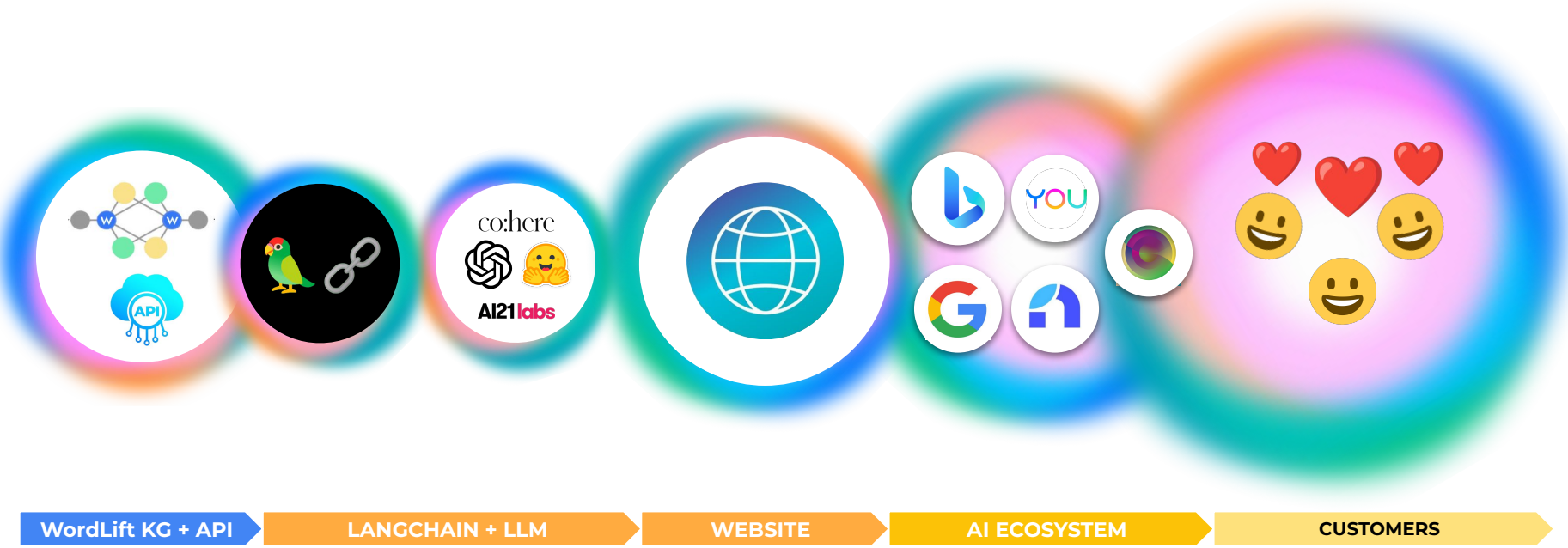
wordlift.io/structured-data-audit



wordlift.io/talk-to-my-vc



Leverage **knowledge graphs** to **generate** and **validate content** at scale



**Are you
ready for a
quick test?**

wor.ai/ai-question-answering

"<https://s.mj.run/Yp5Y0HuWxus> by the Italian painter Michelangelo Merisi da Caravaggio --v 4"



Don't forget you are an SEO

(...not just an AI nerd).

Let's talk...



cyberandy



/in/volpini/

BONUS SLIDE



Learnings

1. LLMs are **unsafe, biased** and **racist** (among other well-known limitations).
2. The **feedback-loop** is king. You need a **magic loop that unleashes human creativity** and blends it with Generative AI.
3. You need a **data fabric** (and a **KG**). Your data, your content and your unique messaging are **as essential as the LLM**.
4. **AI apps** are the new way to interact with your audience.
5. We have to play it safe and **invest on a robust validation pipeline**.

Grazie!

KGC | The Knowledge Graph Conference & **W** WordLift

A circular logo with a white 'W' on a blue and purple gradient background, located in the bottom-left corner of the slide.

W



References

1. [\[colab\] A quick introduction to CLIP and Multimodal Search](#)
2. [\[space\]Point-E demo: text to 3D - Hugging Face](#)
3. [\[colab\] A quick introduction to Transformer Language Models](#)
4. [\[colab\] Self-Ask implementation](#)
5. [\[demo\] Question & Answering from Web Documents](#)
6. [\[colab\] Validating AI-Generated product descriptions](#)
7. [\[Article\] Generative AI For SEO: An Overview](#)
8. [\[Article\] ChatGPT for SEO: Leverage Generative AI To Outperform Your Competitors](#)
9. [\[Article\] Top 5 Best Plagiarism Checkers For AI-Generated Content](#)