

“Practical Applications of Knowledge Graphs and AI in Search”

pureinsights™

Phil Lewis

CTO

phil.lewis@pureinsights.com

Three Pillars of our Business



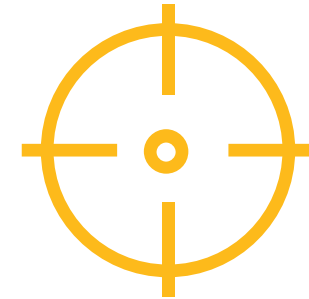
Consulting

- Trusted advisors, strategists, and engineers
- Technology agnostic
- Focused on customer needs and business goals



Technology

- Pureinsights Discovery Platform™
 - Connect data sources
 - Process, stage and reprocess
 - Hydrate knowledge graphs
 - UI that elevates the user experience



SearchOps™

- Enterprise SearchOps™ - fully managed search application services
- We run your search application so you can focus on your business
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- 4 Web 2.0, Cloud, Mobile
- 5 Big Data, Analytics, Visualization
- 6 IoT and Smart Machines
- 7 Artificial Intelligence
- 8 Quantum Computing

- Big Data
- Machine Learning
- Neural AI Models
- Cloud Compute

1950 Turing Test

1964: System/360
Server/Host

1972: SAP

1977: PC

1969: ARPANET

1990: System/390

1999: Salesforce.com

1997: Big Data

1999: IOT, M2M

2005: Web 2.0

2006: AWS

2008: iPhone

2010: Sales of PC Peak

2014, IDC: 4.4 Zettabytes of data

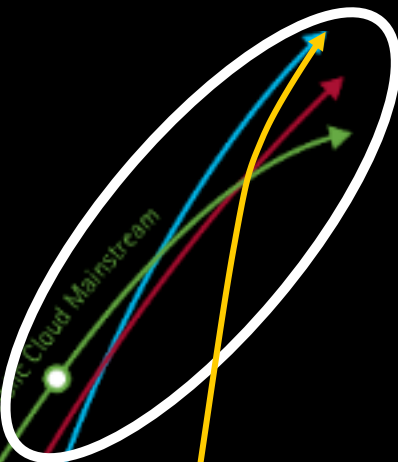
2010: Self-driving car

Public Cloud Mainstream

Today

Quantum

AI



Time

1960 1970 1980 1990 2000 2010 2020 2030

Text

Document information

Procedure

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Table of contents

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Title and reference

Regulation (EU) 2019/125 of the European Parliament and of the Council of 16 January 2019 concerning trade in certain goods which could be used for capital punishment, torture or other cruel, inhuman or degrading treatment or punishment

PE/59/2018/REV/1

OJ L 30, 31.1.2019, p. 1–57 (BG, ES, CS, DA, DE, ET, EL, EN, FR, GA, HR, IT, LV, LT, HU, MT, NL, PL, PT, RO, SK, SL, FI, SV)

In force: This act has been changed. Current consolidated version: 01/01/2021

ELI: <http://data.europa.eu/eli/reg/2019/125/oj>

Languages, formats and link to OJ

	BG	ES	CS	DA	DE	ET	EL	EN	FR	GA	HR	IT	LV	LT	HU	MT	NL	PL	PT	RO	SK	SL	FI	SV
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Text

31.1.2019 EN Official Journal of the European Union L 30/1

REGULATION (EU) 2019/125 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 16 January 2019

concerning trade in certain goods which could be used for capital punishment, torture or other cruel, inhuman or degrading treatment or punishment

(codification)

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty on the Functioning of the European Union, and in particular Article 207(2) thereof,

Having regard to the proposal from the European Commission,

After transmission of the draft legislative act to the national parliaments,

Acting in accordance with the ordinary legislative procedure ⁽¹⁾,

Whereas:

- (1) Council Regulation (EC) No 1236/2005 ⁽²⁾ has been substantially amended several times ⁽³⁾. In the interests of clarity and rationality, that Regulation should be codified.
- (2) Pursuant to Article 2 of the Treaty on European Union, respect for human rights constitutes one of the values common to the Member States. The European Community resolved in 1995 to make respect for human rights and fundamental freedoms an essential element of its relations with third countries. It was decided to insert a clause to that end in any new trade, cooperation and association agreement of a general nature concluded with third countries.
- (3) Article 5 of the Universal Declaration of Human Rights, Article 7 of the International Covenant on Civil and Political Rights and Article 3 of the European Convention for the Protection of Human Rights and Fundamental Freedoms all lay down an unconditional, comprehensive prohibition on torture and other cruel, inhuman or degrading treatment or punishment. Other provisions, in particular the United Nations Declaration on the Protection of All Persons from Being Subjected to Torture and Other Cruel, Inhuman or Degrading Treatment or Punishment ⁽⁴⁾ and the 1984 United Nations Convention against Torture and Other Cruel, Inhuman or Degrading Treatment or Punishment ⁽⁵⁾ have further strengthened the prohibition.

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- Body of European Regulators for Electronic Communications (11)
- Advisory Committee on Concentrations (1)
- Advisory Committee on Restrictive Practices and Dominant Positions (3)
- EC-Switzerland Inland Transport Committee (8)

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Subject: [conservation of resources](#), [ecology](#), [environmental law](#), [environmental protection](#), [environmental standard](#), [EU environmental policy](#), [EU Member State](#), [European Union](#), [job creation](#)

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“What is the global annual profit from trafficking humans ?” returned 135476 results

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Study on the economic, social and human costs of trafficking in human beings within the EU

The purpose of the Study is to measure the cost of **trafficking in human** beings in the European Union. **Trafficking in human** beings is a particularly serious crime, driven by **profits** and involves a chain of actors who are knowingly or unknowingly involv...

Published: 2020-10-16

Subject: [trafficking in human beings](#), [access to the courts](#), [child protection](#), [European Union](#), [fight against crime](#), [help for victims](#), [policymaking](#), [report](#), [rights of the individual](#), [sexual violence](#), [slavery](#), [victim](#), [woman](#)

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Implementation of Directive 2011/36/EU Migration and gender issues : European implementation assessment

Directive 2011/36/EU (Anti-**Trafficking** Directive) is the benchmark legislation on the fight against **human trafficking** at European level. The aim of this European implementation assessment is to gather evidence on the progress and challenges that occur in the implementa...

Published: 2020-09-30

Subject: [human rights](#), [trafficking in human beings](#), [directive \(EU\)](#), [EU Member State](#), [gender equality](#), [help for victims](#), [migration](#)

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Judgment of the Court of **20 October 1993**. Phil Collins v Imtrat Handelsgesellschaft mbH and Patricia Im- und Export Verwaltungsgesellschaft mbH and Leif Emanuel Kraul v EMI Electrola GmbH. References for a preliminary ruling: Landgericht München I and Bundesgerichtshof - Germany.

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[Joined Cases C-92/92 and C-326/92 Phil Collins v ... - EUR-Lex](#)

Phil Collins v. Imtrat Handelsgesellschaft mbH (**Case C-92/92**) and. Patricia Im-und Export Verwaltungsgesellschaft ... (References for a preliminary ruling.

<https://www.quimbee.com> › ... › Case Briefs › P

[Phil Collins v. Imtrat Handelsgesellschaft GmbH - Quimbee](#)

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<https://www.independent.co.uk> › UK

[Phil Collins wins court fight over bootleg recordings](#)

20 Oct 1993 — Mr **Collins**, a drummer in the rock group Genesis and a successful solo artist, has been waging a long- running battle to stop **Imtrat** ...

Missing: handelsgeselshafft | Must include: handelsgesellschaft

<https://ipcuria.eu> › case

[CJEU - Judgment C-92/92 Phil Collins 20 Oct 1993 - IPcuria.eu](#)

20 Oct 1993 — CJEU preliminary ruling. Judgment C-92/92 Phil Collins 20 Oct 1993 — Phil

when was the phil collins vs imtrat handelsgesellschaft decision?



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20 October 1993

Judgment of the Court of **20 October 1993**. # Phil Collins v Imtrat Handelsgesellschaft mbH and Patricia Im- und Export Verwaltungsgesellschaft mbH and Leif Emanuel Kraul v EMI Electrola GmbH. # References for a preliminary ruling: Landgericht München I and Bundesgerichtshof - Germany. # Article 7 of the Treaty - Copyright and related rights. # Joined cases C-92/92 and C-326/92. Phil Collins and Others TITJUR 36 The costs incurred by the German Government, the United Kingdom and the Commission of the European Communities, which have submitted observations to the Court, are not recoverable. Since these proceedings are, for the parties to the main proceedings, a step in the action pending before the national court, the decision on costs is a matter for that court.

Feb 12,2021

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Arrêt de la Cour du 20 octobre 1993. # **Phil Collins** contre **Imtrat Handelsgesellschaft mbH** et Patricia Im- und Export Verwaltungsgesellschaft,**Phil Collins** e.a. mbH et Leif Emanuel Kraul contre EMI...

61992CJ0092

ECLI: ECLI:EU:C:1993:847

Author: Cour de justice



Conclusions de l'avocat général Jacobs présentées le 30 juin 1993. # **Phil Collins** contre **Imtrat Handelsgesellschaft mbH** et Patricia Im- und Export Verwaltungsgesellschaft,**Phil Collins** e.a. mbH et...

61992CC0092

ECLI: ECLI:EU:C:1993:276

Author: Cour de justice



Judgment of the Court of 20 October 1993. # **Phil Collins** v **Imtrat Handelsgesellschaft mbH** and Patricia,References for a preliminary ruling: Landgericht München I and Bundesgerichtshof - German...

What Are The Ethylene Capacity Rates In Western Europe?



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96 %

2002/792/EC: Commission Decision of 20 December 2001 declaring a concentration to be compatible with the common market and the EEA Agreement (Case No COMP/M.2533 — BP/E.ON) (Text with EEA relevance) (notified under document number C(2001) 4527) CELEX1 (122) Ethylene production capacity utilisation rates are estimated at around **96 %** in Western Europe and even higher in the ARG area. Therefore, significant volumes to exercise competitive pressure on the market could only derive from new capacity to come on stream in the near future and which would not be absorbed by increased captive use, but would be available for the merchant market. However, this is not the case for the ARG-area.

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Décision (UE) 2018/262 de la Commission du 14 février 2018 relative à la proposition d'initiative citoyenne intitulée «We are,a welcoming Europe, let us help!» a welcoming Europe, let us help!»...

32018D0262

Subject: citoyenneté européenne, politique migratoire de l'UE, aide aux réfugiés, admission des étrangers, pétition, ressortissant étranger, intégration des migrants
Author: Secrétariat général, Commission européenne



Mr A. MOLENAAR

Policy Analyst

European Commission - IDEA – Inspire, Debate, Engage and Accelerate Action - Deputy Head of IDEA 1 - Geopolitics and Europe in the Global Order (IDEA.A.2)
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How much is Turkey contributing towards the ongoing costs of the EUPM?



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EUR 25000 Per Year

CELEX1 Agreement between the European Union and the Republic of Turkey on the participation of the Republic of Turkey in the European Union Police Mission (EUPM) in Bosnia and Herzegovina (BiH) 1. The Republic of Turkey shall contribute to the running costs of the EUPM an amount of **EUR 25000 per year**. The Republic of Turkey shall consider making additional contributions of a voluntary nature to these running costs, taking into account its means and level of participation.

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**Exchange of letters on the provisional application of the Agreement between the European Atomic Energy,Community and the Government of the United Kingdom of Great Britain and Northern Ireland...**

22020A1231(05)

Subject: politique nucléaire, sûreté nucléaire, énergie nucléaire, retrait de l'UE, Royaume-Uni, accord intérimaire (UE), accord de coopération (UE), utilisation pacifique d'énergie, Brexit

Author: Royaume-Uni, Communauté européenne de l'énergie atomique

**Regulation No 94 Uniform provisions concerning the approval of vehicles with regard to the protection,of the occupants in the event of a frontal collision of the occupants in the event of a...**

42005X0822(01)

Subject: véhicule à moteur, équipement de véhicule, dispositif de sécurité, homologation, rapprochement des législations, réglementation technique, Ecosoc

Author: Commission économique pour l'Europe

**Regulation No 95 Uniform provisions concerning the approval of vehicles with regard to the protection,of the occupants in the event of a lateral collision of the occupants in the event of a later...**

42005X0822(02)

what's the case number for the accenture global services vs silver creek properties ca All

About 92,410 results Sort By

T-244/09

Judgment of the General Court (Eighth Chamber) of 7 October 2010. # Accenture Global Services GmbH v Office for Harmonisation in the Internal Market (Trade Marks and Designs) (OHIM). # Community trade mark - Opposition proceedings - Application for Community figurative mark acsensa - Earlier Community and national word and figurative marks ACCENTURE and accenture - Relative ground for refusal - No likelihood of confusion - No similarity of signs - Article 8(1)(b) of Regulation (EC) No 40/94 (now Article 8(1)(b) of Regulation (EC) No 207/2009) - Obligation to state reasons - Article 73 of Regulation No 40/94 (now Article 75 of Regulation No 207/2009. # Case **T-244/09**. TITJUR Accenture Global Services v OHMI-Silver Creek Properties (acsensa) German trade mark registration for the word mark ACCENTURE for goods and services in Classes 9, 16, 35 to 37, 41 and 42; German trade mark registration of the figurative mark accenture for goods and services in Classes 9, 16, 35 to 37, 41 and 42; Community trade mark registration of the word mark ACCENTURE for goods and services in Classes 9, 16, 35 to 37, 41 and 42; Community trade mark registration of the figurative mark accenture for goods and services in Classes 9, 16, 35 to 37, 41 and 42

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Accenture Global Services / OHMI-Silver Creek Properties (acsensa),. # Accenture Global Services GmbH contre Office de l'harmonisation dans le marché intérieur (marques,communautaire figurative...
 62009TJ0244
 ECLI: ECLI:EU:T:2010:430
 Subject: amende, droit des marques, marque de l'UE, dénomination du produit, violation du droit de l'UE, recours en annulation (UE), Office de l'Union européenne pour la propriété intellectuelle...



Judgment of the General Court (Eighth Chamber) of 7 October 2010. # Accenture Global Services GmbH vOffice for Harmonisation in the Internal Market (Trade Marks and Designs) (OHIM). #...

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Mr Alan NORTON

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tel: +32-229-91111...



Arrêt du Tribunal de première instance (quatrième chambre) du 23 janvier 2008. # Demp BV contre Office de l'harmonisation dans le marché intérieur (marques, dessins et modèles) (OHMI). # Marque...

62006TJ0106
ECLI: ECLI:EU:T:2008:14
Subject: matériau de construction, droit des marques, marque de l'UE, recours en annulation (UE), Office de l'Union européenne pour la propriété intellectuelle, outil de bricolage, outillage

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Conclusions de l'avocat général M. G. Pitruzzella, présentées le 28 février 2019, Pitruzzella, présentées le 28 février 2019., consommateurs – Directive 2011/83/UE – Article 6, paragraphe 1, sous c) –...

62017CC0649
ECLI: ECLI:EU:C:2019:165
Subject: information du consommateur, contrat, téléphone, moyen de communication, vente à distance
Author: Cour de justice



Judgment of the Court (Second Chamber) of 27 May 1982. # Francis Aubin v Union nationale interprofessionnelle pour l'emploi dans l'industrie et le commerce,(UNEDIC) and Association pour...

61981CJ0227

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1. The Republic of Turkey shall contribute to the running costs of the EUPM an amount of <span class=\"highlighting\">EUR 25000 per year</span>. The Republic of Turkey shall consider making additional contributions of a voluntary nature to these running costs, taking into account its means and level of participation."
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1. The Republic of Turkey shall contribute to the running costs of the EUPM an amount of <span class=\"highlighting\">EUR 25000 per year</span>. The Republic of Turkey shall consider making additional contributions of a voluntary nature to these running costs, taking into account its means and level of participation."
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    {
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      "highlight": "CELEX1 Agreement between the European Union and the Republic of Turkey on the participation of the Republic of Turkey in the European Union Police Mission (EUPM) in Bosnia and Herzegovina (BiH)  
3. The Republic of Turkey shall formally communicate to the EUPM and to the General Secretariat of the Council of the European Union <span class=\"highlighting\">the total amount of its contribution to the
```

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{
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      "entity": "M. Michael WINTER",
      "attribute": "Adresse",
      "url": "http://publications.europa.eu/resource/directory/person/UNDEFINED_NRE525416",
      "dataSource": "EU Whoiswho"
    },
    {
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    },
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      "value": "Vice-président",
      "entity": "M. Michael WINTER",
      "attribute": "Position",
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      "dataSource": "EU Whoiswho"
    },
    {
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      "entity": "M. Michael WINTER",
      "attribute": "Numéro de Téléphone",
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      "dataSource": "EU Whoiswho"
    },
    {
      "value": "Agences et organismes - Agences - Autorité européenne de sécurité des aliments - Conseil d'administration",
      "entity": "M. Michael WINTER",
      "attribute": "Organisation",
      "url": "http://publications.europa.eu/resource/directory/person/UNDEFINED_NRE525416",
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}
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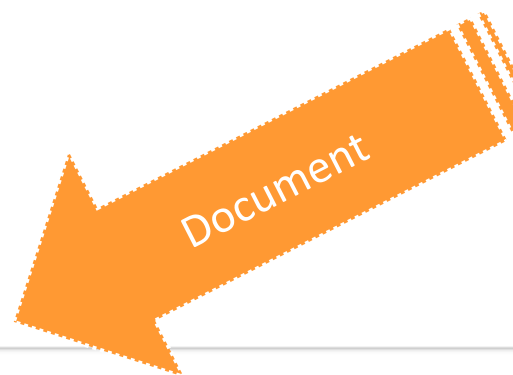
How was this done?

“**COGNITIVE SEARCH**”

Cognitive Search uses **AI technology** such as **Natural Language Processing (NLP)**, **semantic understanding**, **machine learning** and **knowledge graphs** to provide a cognitive search experience.

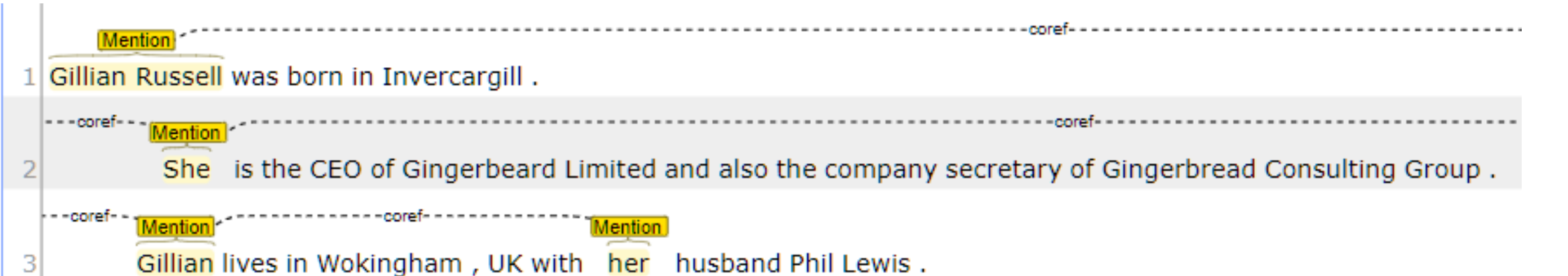
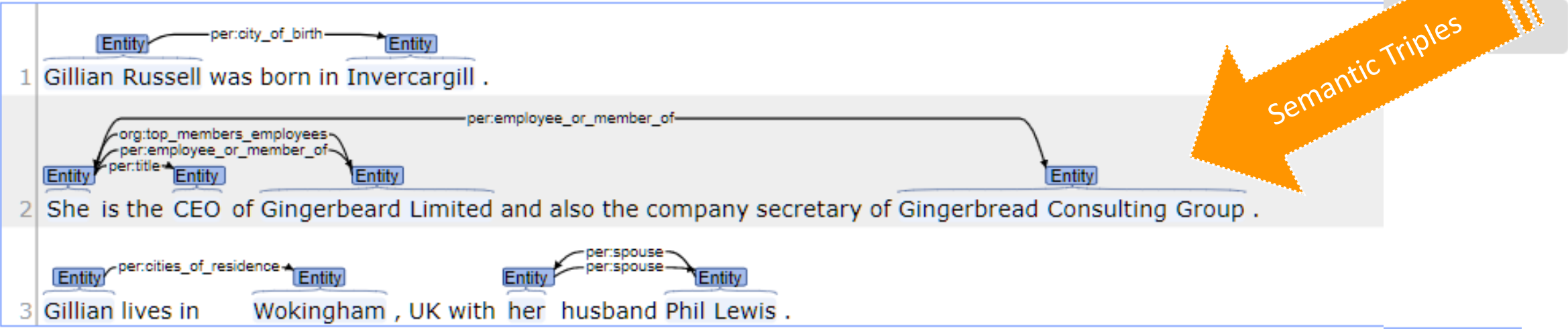


NATURAL LANGUAGE PROCESSING



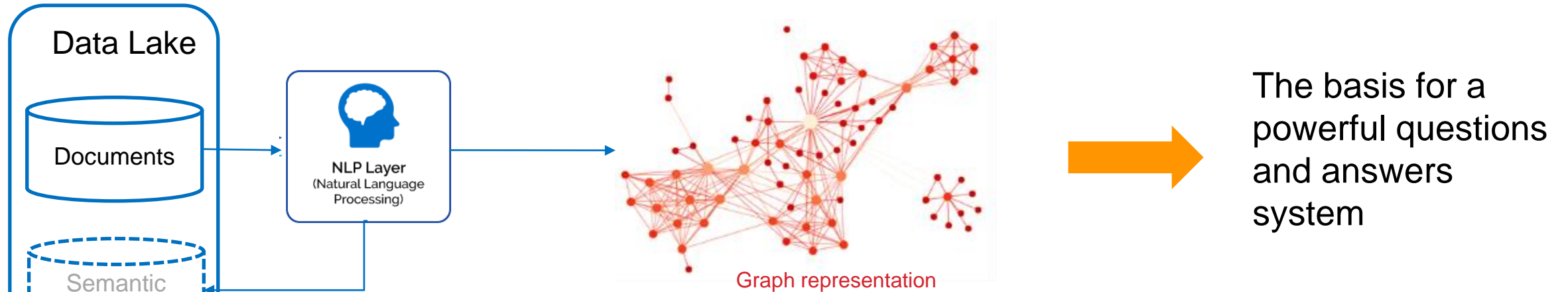
— Text to annotate —

Gillian Russell was born in Invercargill. She is the CEO of Gingerbread Limited and also the company secretary of Gingerbread Consulting Group. Gillian lives in Wokingham, UK with her husband Phil Lewis.



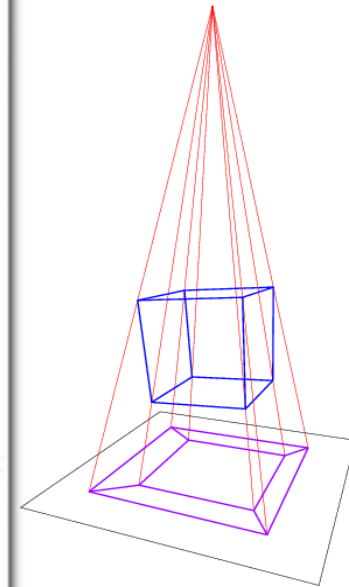
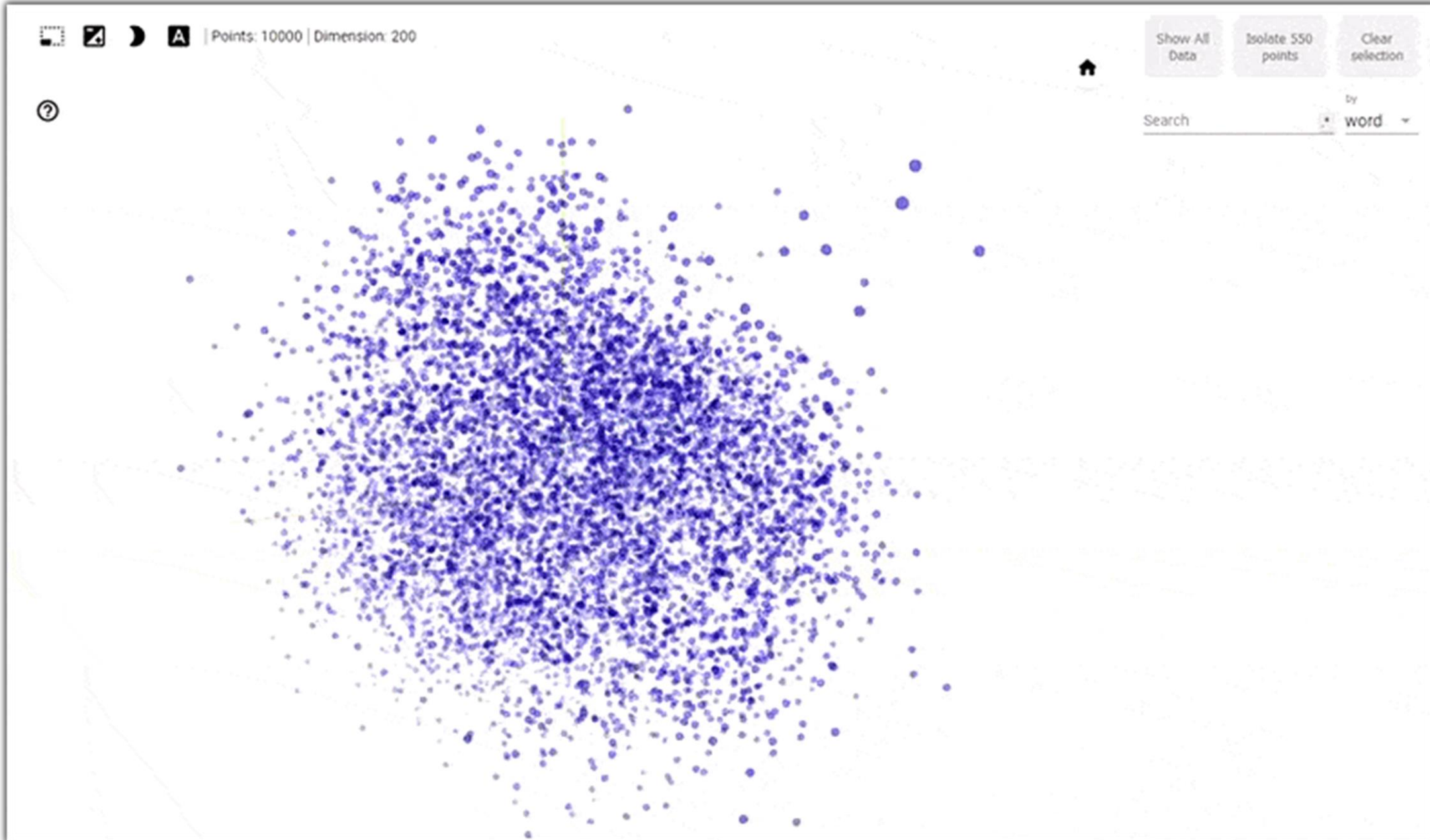
MODELLING KNOWLEDGE

Generating Semantic Triples



Semantic
Triples

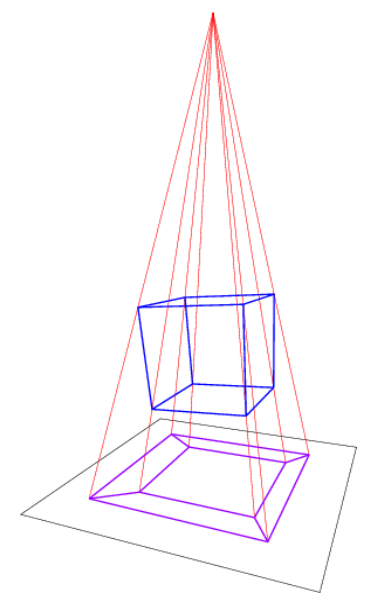
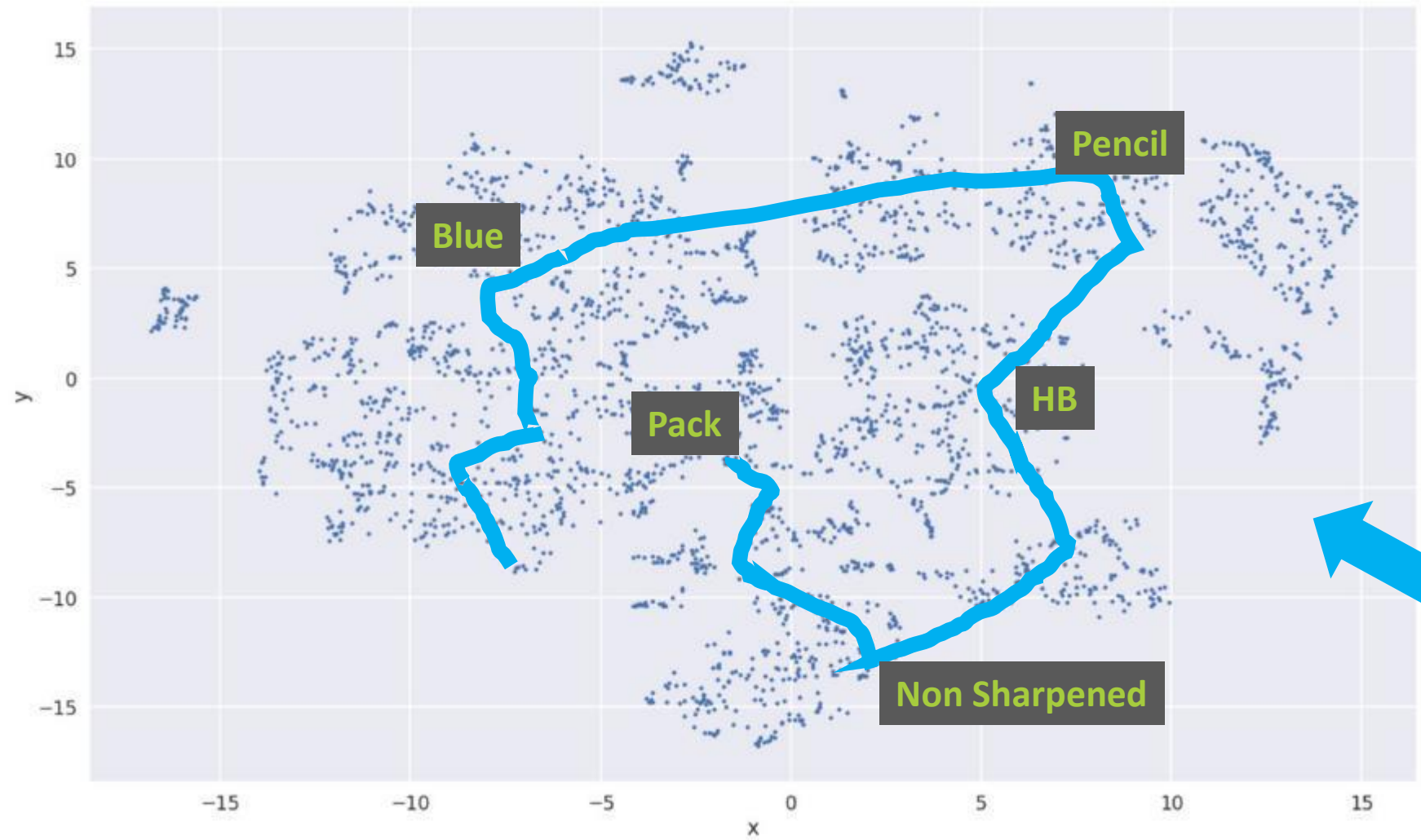
Subject	Predicate	Object
Gillian Russell	ORG-TOP-EMPLOYEES	Gingerbeard Limited
Gillian Russell	ORG-TOP-EMPLOYEES	Gingerbeard Consulting Ltd
Gillian Russell	PER-BIRTH-PLACE	Invercargill
Gillian Russell	PER-RESIDENCE	Wokingham, UK
Gillian Russell	PER_SPOUSE	Phil Lewis



3 Shadow of 200+ dimensional space

AI - VECTOR SEARCH

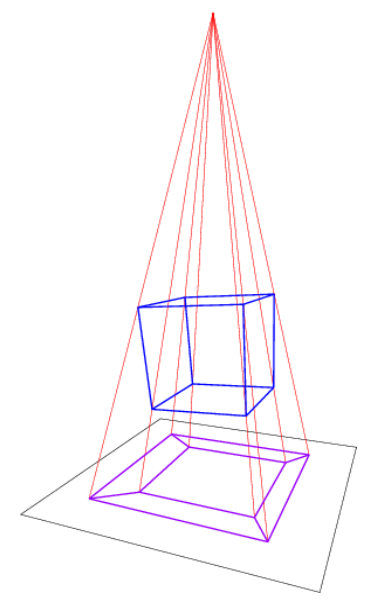
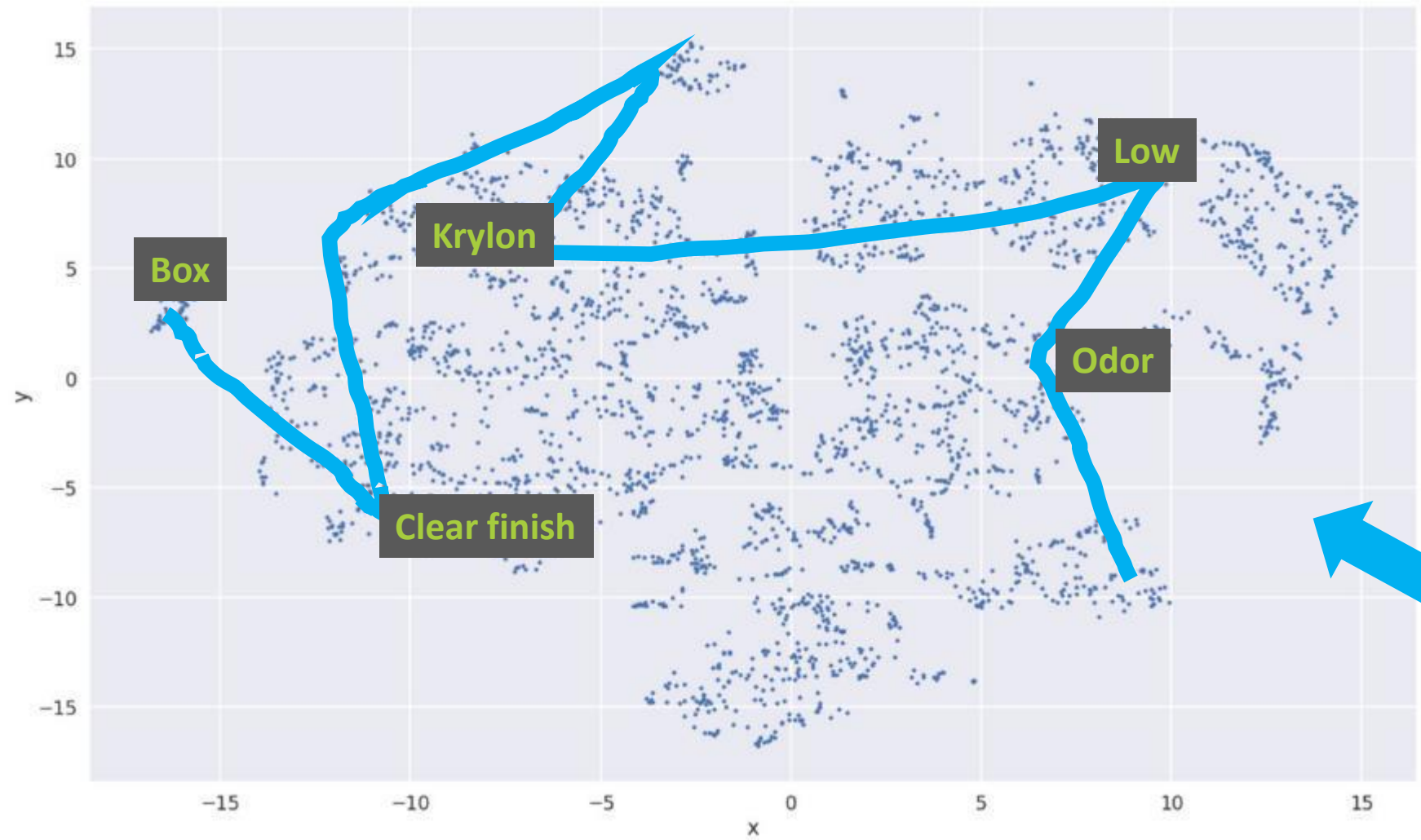
word2Vec, Word Embeddings, BERT, RankBrain



Shadow of 300+ dimensional space

AI - VECTOR SEARCH

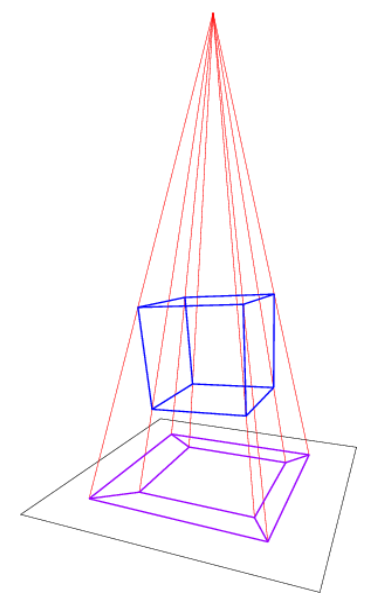
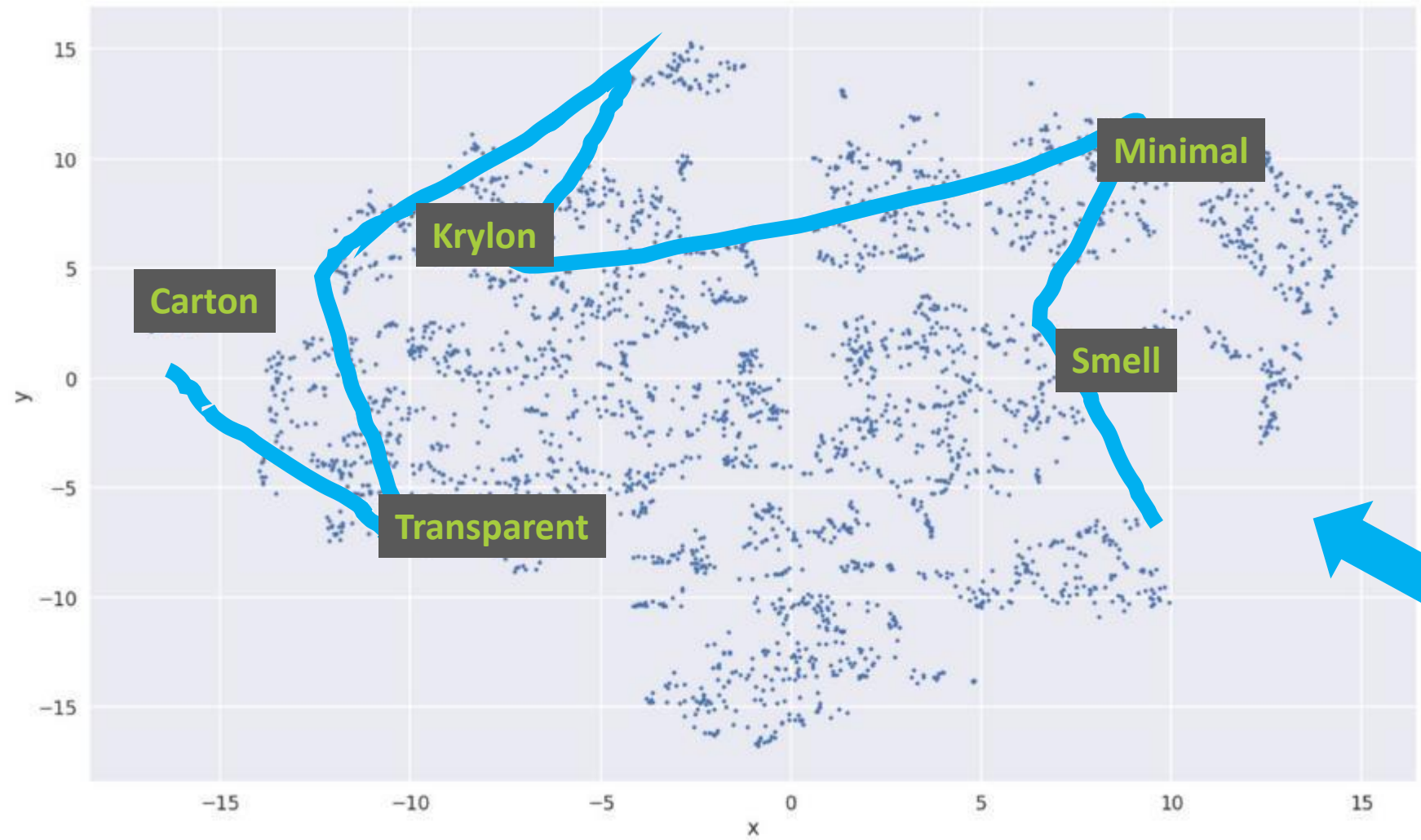
word2Vec, Word Embeddings, BERT, RankBrain



Shadow of 300+ dimensional space

AI - VECTOR SEARCH

word2Vec, Word Embeddings, BERT, RankBrain



Shadow of 300+ dimensional space

AI Services

spaCy

Google BERT

Hugging Face



Content Sources



Data Repository Connectors

Hydrate

- Documents
- Containers
- Security
- Metadata

Connector

Document Staging Repository

Document View vs Database View

Hydrate

Documents
Vectors

Content Processing Pipelines

Search Engine



- Keyword Search
- Vector Search

Knowledge Graph



- Semantic Triple Store
- Relationships Store
- Fact Store
- FAQ Store
- Entity Store

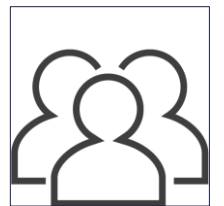
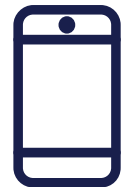
Hydrate
Semantic
Triples

Hydrate

Security Credentials

Query (NLP) API

- Query Processing
- Security Filtering
- Results
- Query Snapping Mark-up



Connect

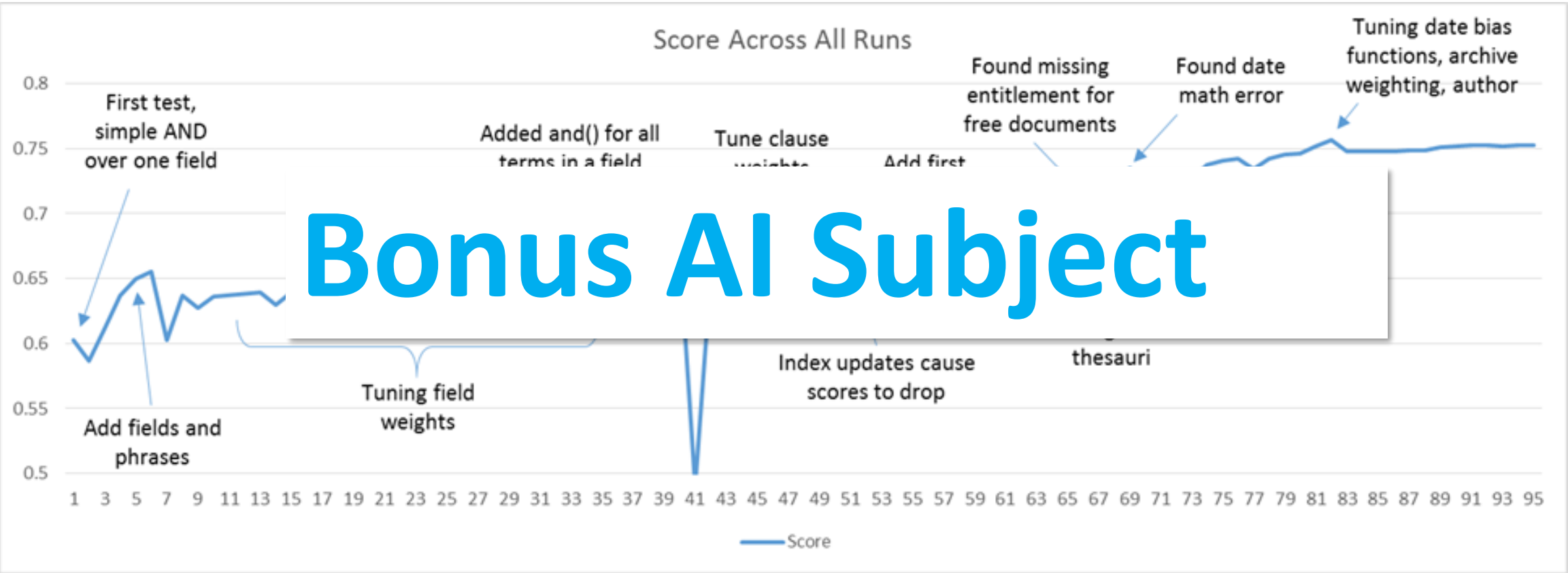
Process

Hydrate

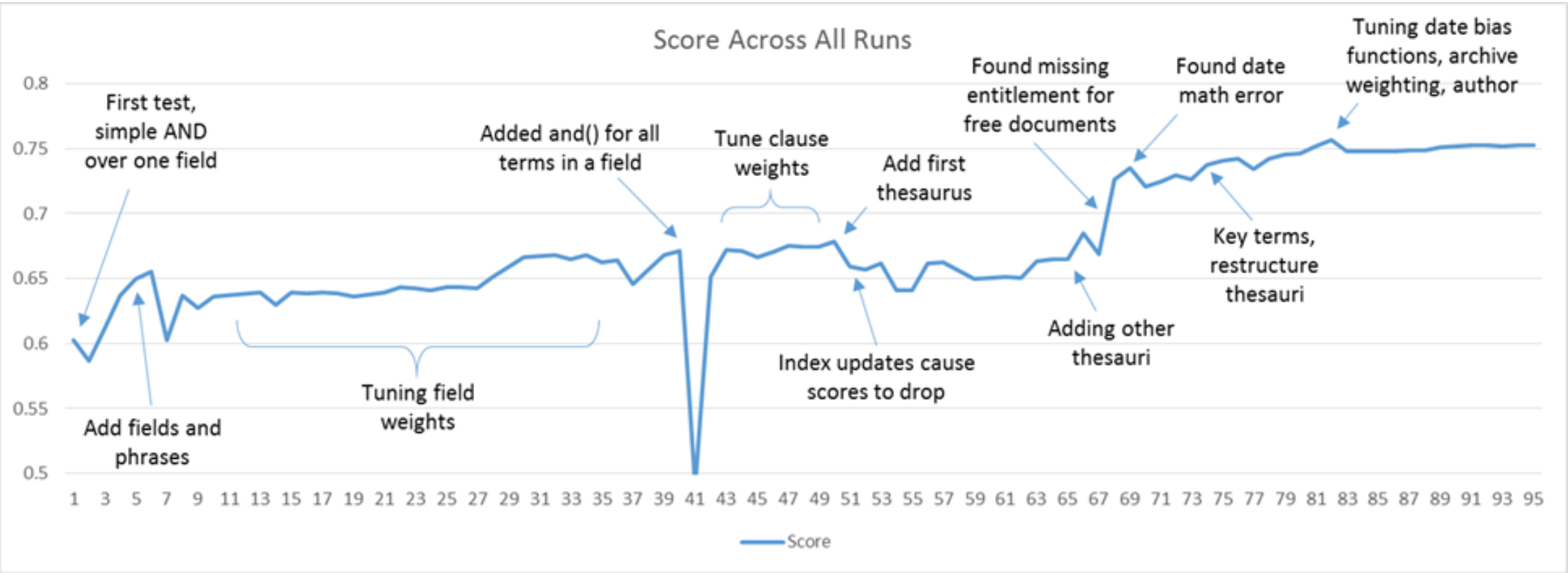
Interface



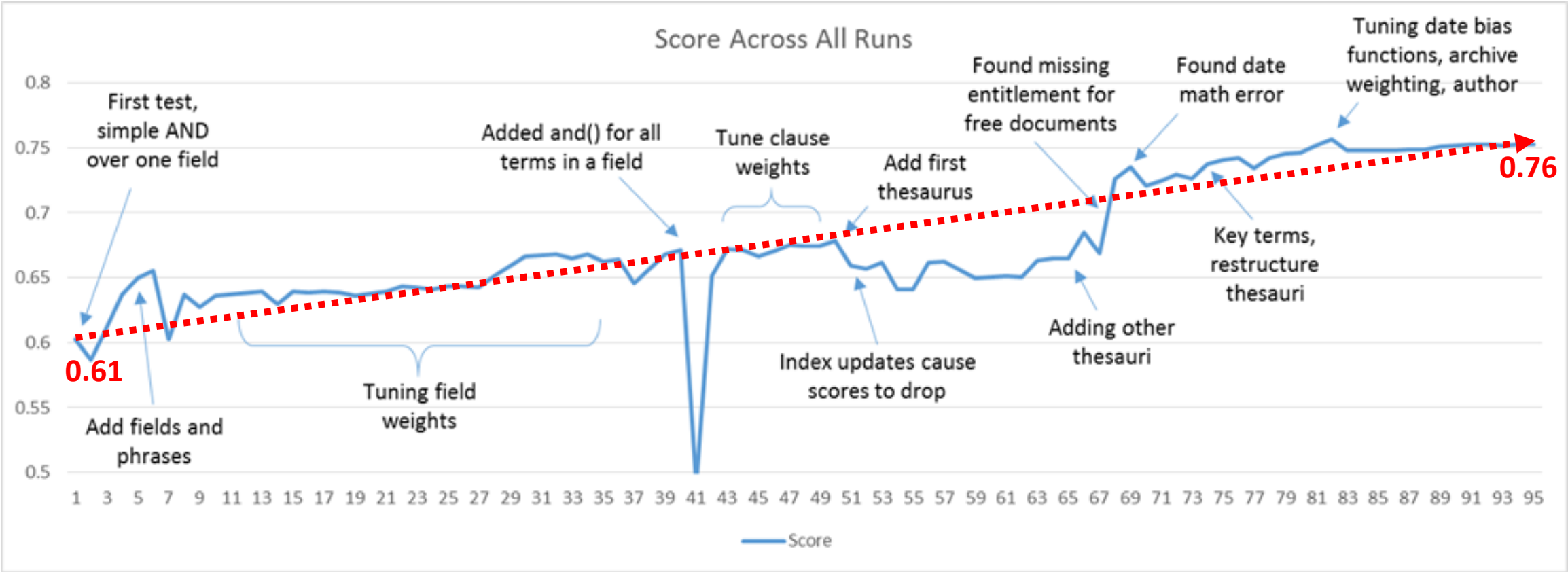
Questions?



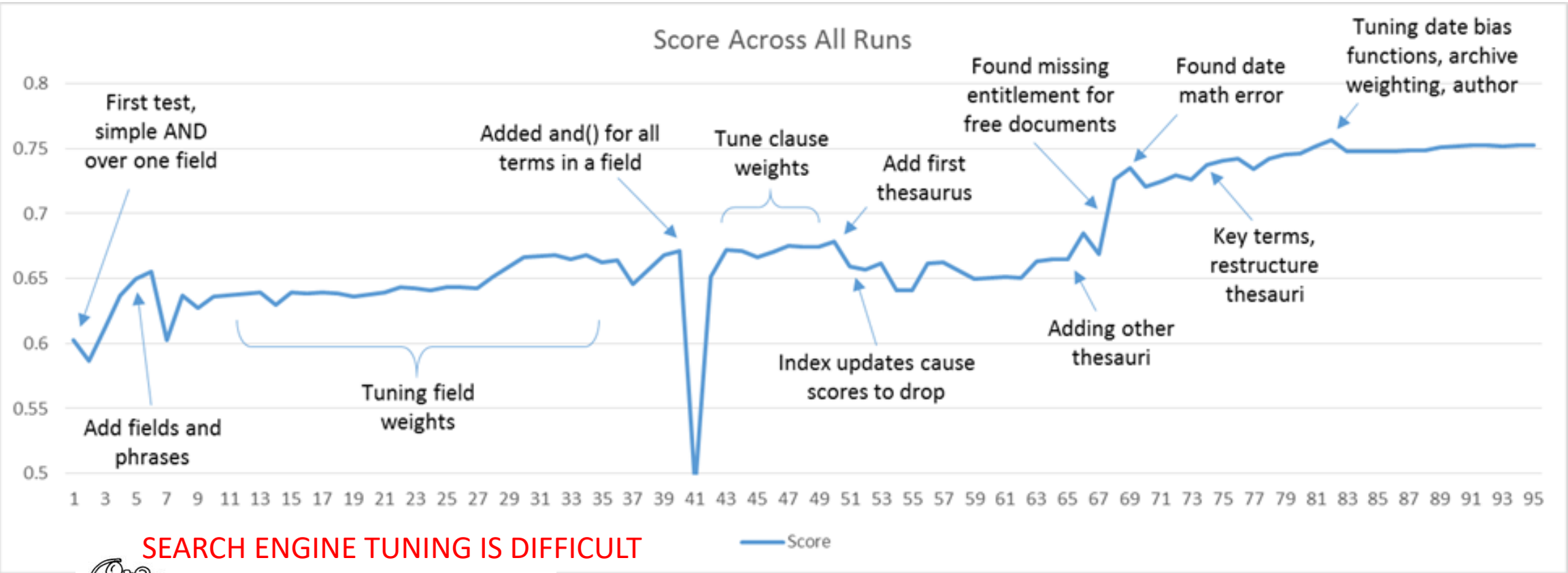
Search Relevancy Scoring OVER TIME



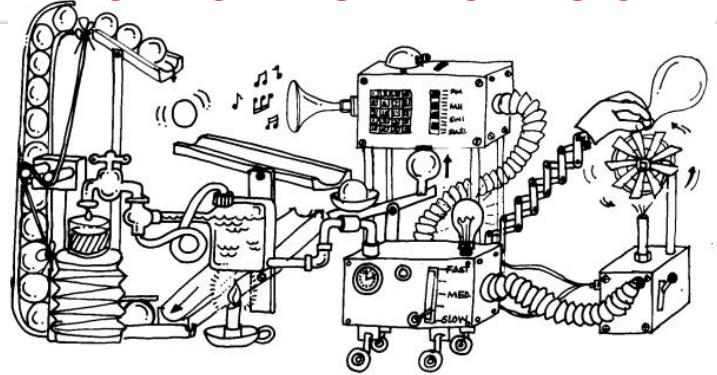
Search Relevancy Scoring OVER TIME



Search Relevancy Scoring OVER TIME



SEARCH ENGINE TUNING IS DIFFICULT



- Many parameters to change
- Many interactions between them all
- Too many parameters for humans to keep track of
- Goal seeking algorithms utilized to self optimise relevancy
- Plays with search parameters to find most optimal settings
- Requires a strong engine scoring methodology to start with

AUTO OPTIMIZATION USING AI

Automated parameter optimization using AI – Requires Engine Scoring

Goal : Automatically optimize Search Engine parameters for best engine scores.

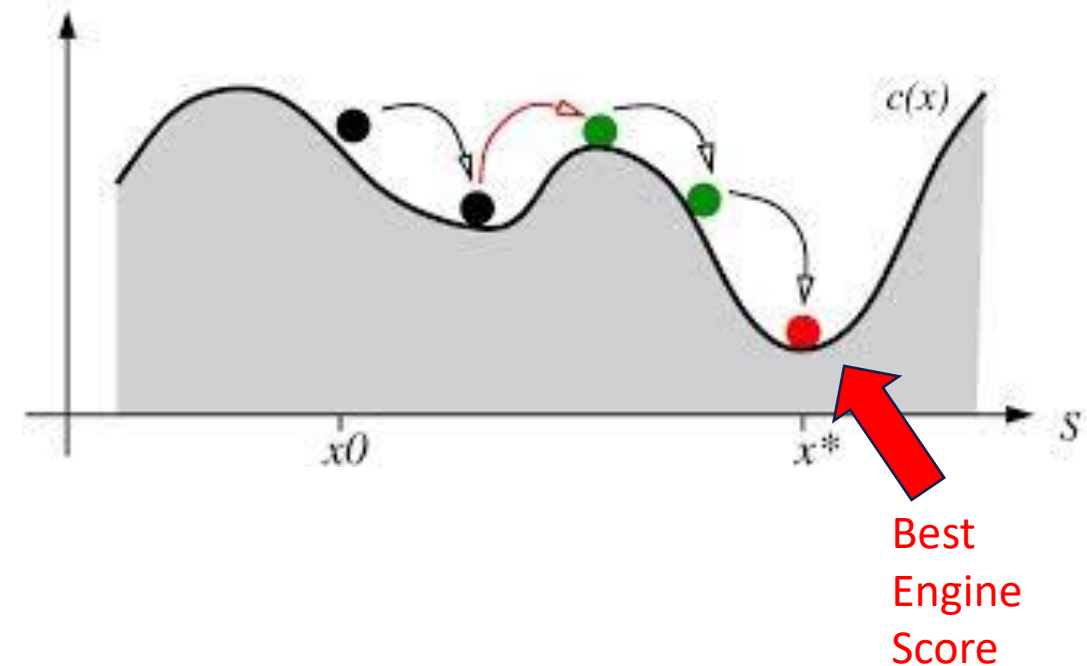
If a customer had tried every single combination of parameter values, it would have resulted in more than 10^{27} iterations!

Using “Simulated Annealing” goal seeking algorithms

We optimised the parameters by running just 3,000 iterations.

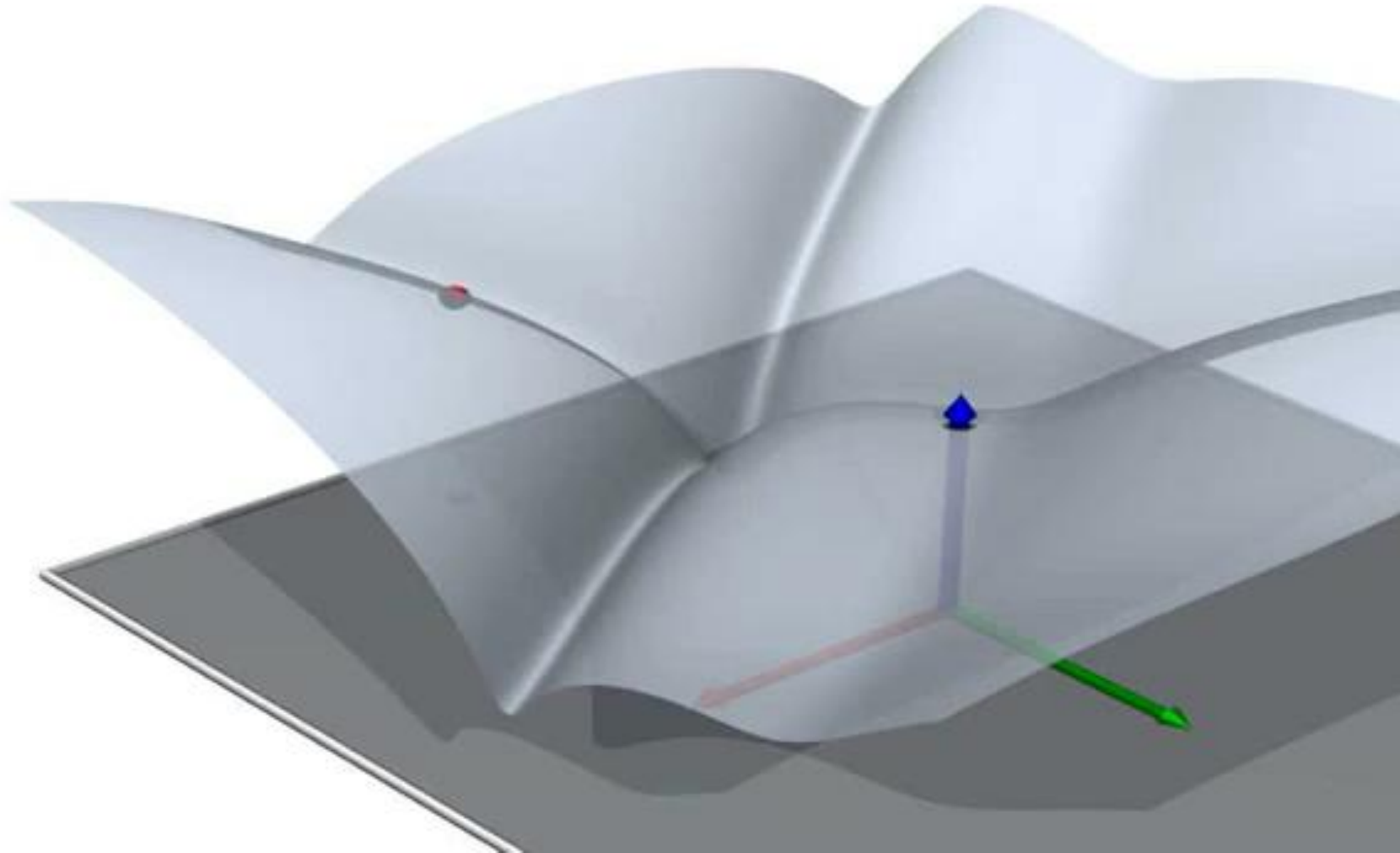
The optimum parameter set was found after 1,600 iterations overnight, and this resulted in:

- **22% increase** in Precision for the top 10 results.
- **37% increase** in Mean Average Precision for the top 10 results.
- **8% increase** in NDCG (*Normalized Discounted Cumulative Gain*) for the top 20 results.



AUTO OPTIMIZATION USING AI

Simulated Annealing, Goal Seeking AI



Questions?