



LIFE SCIENCES ACCELERATOR
FORUM

Capgemini 

Reinvigorating life sciences with GenAI

2024 LIFE SCIENCES ACCELERATOR FORUM



How Generative AI will revolutionize the Life Sciences industry?



Justin Melnick

*R&D Transformation Partner
Life Sciences*

CAPGEMINI





Pioneering Life Science with **ARTIFICIAL INTELLIGENCE**

How (gen)AI will revolutionize the life science industry – *A life scientist's perspective*

Justin Melnick – R&D Transformation Partner

Capgemini 

ARTIFICIAL INTELLIGENCE IS NOT AS NEW AS YOU THINK IT IS

1949 Warren Weaver proposes the idea of statistical machine translation, which now forms the basis of most translation systems



1950 Alan Turing proposes framework for creating and evaluating intelligent machines



1955 Arthur Samuel creates a checkers system that **learns** to play and human equivalent level

1951 First Neural Network SNARC is built at MIT

1951 Chess and Checkers playing algorithms run for the first time

1956 Artificial Intelligence is coined as a term and academic interest explodes

1974 MYCIN AI system used in medical diagnosis

1958 LISP programming language invented to support AI research

1971 First Deep Learning Systems created

1959 MIT AI Lab is founded

1960s

1961 First Robot works on a production line

1963 Support Vector Machines invented

1965 Natural Language Processing able to understand and solve written problems, and have simple interactive conversations (ELIZA)

1970s Natural Language Processing performance increases dramatically

1980 Neural networks used routinely on vision problems

1975 Back-propagation kick-starts neural network application

1986 Autoencoders first used

1973 Vision Controlled Robots perform complex tasks

1986 Hinton et al refine use of backprop to achieve massive improvements

1970s

1969 Mobile Autonomous Robots combine together multiple AI systems

1989 Watkins demonstrates Q-Learning opening the door to practical use of reinforcement learning

1980s



2004 DARPA Grand Challenge catalyses huge progress in autonomous driving

1982 Hopfield invents recurrent neural networks

1986 Decision trees invented
1986 First autonomous vehicles drive on the streets

1989 Yann LeCunn uses CNNs to perform character recognition

1990s

1991 TD-Gammon uses reinforcement learning to create championship-level backgammon player

2006 AI is 50 years old as an academic discipline

2012 Siri, Alexa and Google Assistant revolutionise our interaction with technology

2002 Roomba becomes the first mainstream domestic AI device

2000s

1998 Use of AI revolutionises web-search performance

1997 AI becomes world champion at chess

1995 Random Forests invented

1995 Support Vector Machines with kernel trick

1994 AI becomes world champion at checkers

1993 1000 layer deep network used to solve grammar learning tasks



2010s

2011 IBM Watson beats humans at Jeopardy



2014 Deep Learning allows image recognition systems to surpass human performance

2014 GANs catalyse a leap in generative AI by using competing networks.

2015 TensorFlow released by Google Brain

2015 AlphaGo becomes world champion at Go

2016 TPUs accelerate neural network training

2017 AlphaZero becomes world champion Go and Chess by playing only against itself.

2023 Language turns to structure 100s of millions of protein structures predicted at a click

2017 Graph Convolutional Networks open up a new class of ML applications

2017 Transformer networks revolutionise language processing.

2022 ChatGPT thrusts Generative AI into the mainstream

2023 LLMs everywhere small and large with greater capability

2020 Transformers adapted to vision tasks produce a step change in performance



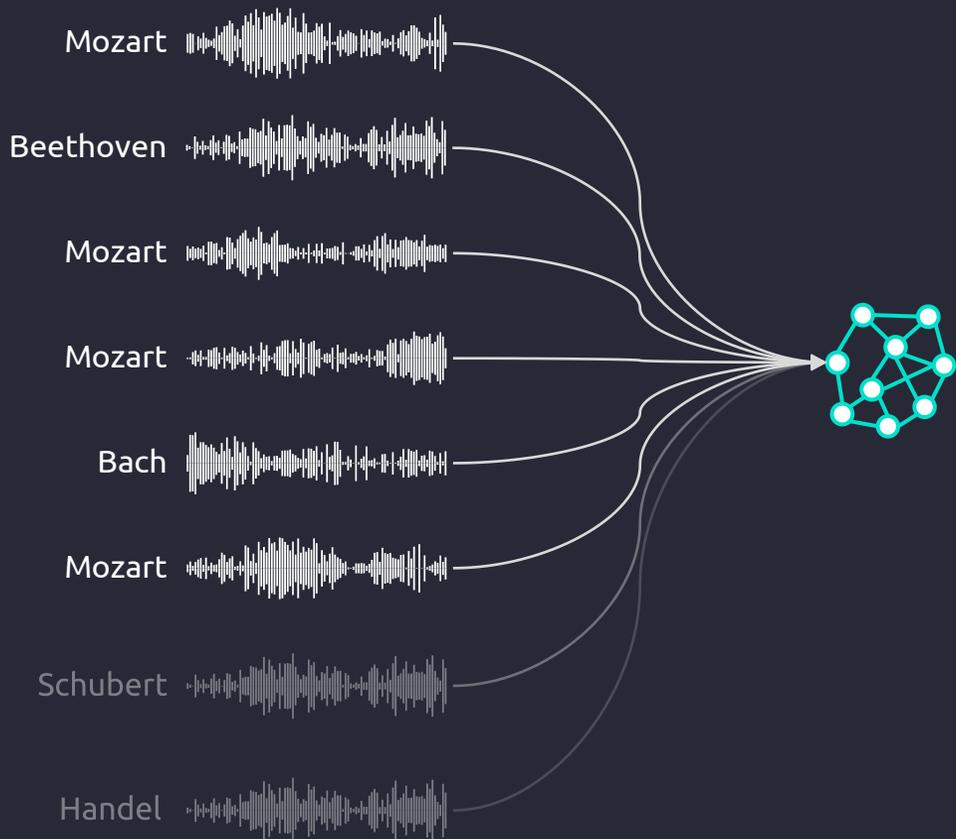
2022 DALL-E 2, Imagen and Stable Diffusion produces realistic images in response to text prompts.

2020 GPT-3 produces human-like written language.





TRAINING

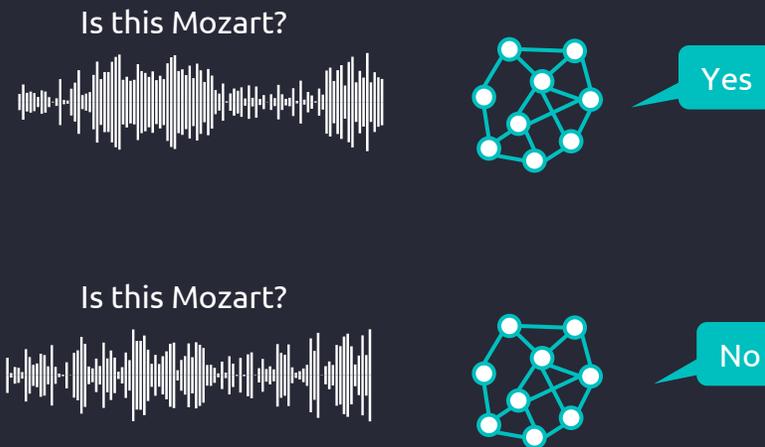


Dominated by text, and Foundation Large Language Models (LLMs) trained on 'the internet'.

Music, text, pictures, audio, video, code, designs, events, geometry, materials, chemicals, ...

The quality of any kind of AI System is heavily dependent on the quality of its training data.

CLASSICAL AI USAGE



GENERATIVE AI USAGE

Make me a piece of music that sounds like Mozart



Generate a version of Beethoven's 5th symphony in the style of Mozart



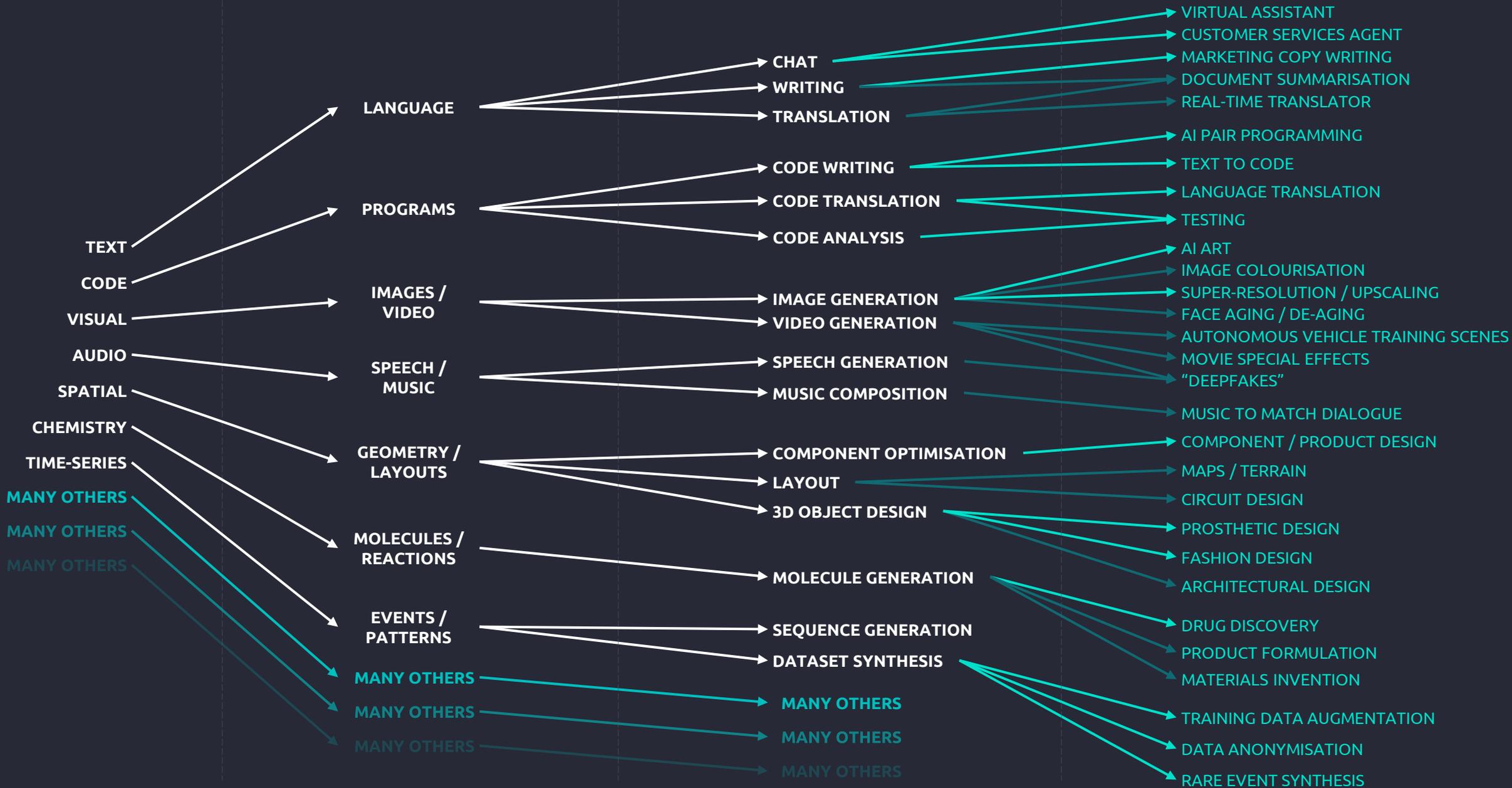


FUNDAMENTAL DATA TYPE

ADD A GRAMMAR/STRUCTURE AND YOU HAVE A MODEL OF...

AND THEN USE THAT GENERATIVE MODEL FOR APPLICATIONS LIKE ...

ILLUSTRATIVE EXAMPLES



PRINCIPLED DEPLOYMENT – PERFECT DELIVERY OF DESIRED VALUE



With principled
DEPLOYMENT,
CHANGING THE
DNA OF WORK
AT YOUR
ORGANIZATION



AUGMENTATION

There is huge power but also limitations of Gen AI. it augments knowledge workers it does not replace them.

FLOW

GenAI output is not guaranteed to be correct, so must be placed inside an end-2-end engineering process to maximise the flow of value & minimise waste.

INDUSTRY

Gen AI is 'not magic', it does not have domain understanding, We need to supplement to bring value to a specific domain, with knowledge of the base science or engineering.

INTEGRITY

Basic engineering principles apply to manage key attributes (quality, security, safety, standards), and the issues of bias and sufficiency of training data.

SUSTAINABILITY

We aim for cheaper and focused models which are more performant and energy efficient.



How will generative AI impact the life science industry?



	AI		OpenAI
NOW (24-25)	<ul style="list-style-type: none">Accelerate screeningDrafting of regulatory documentation	<ul style="list-style-type: none">Streamlining processes and amplifying insightsDesign novel moleculesSynthetic data for clinical trialsContent creation	<ul style="list-style-type: none">Catalyst for innovationReduce cycle times and time to marketAgility that enhances productivity
NEXT (25-27)	<ul style="list-style-type: none">Accelerate move to personalized medicineAnalyze multimodal data sets and infer	<ul style="list-style-type: none">Personalized medicine and precision targetingIdentify patient sub-typesDrug repurposingTargeted therapies	<ul style="list-style-type: none">Paradigm shift to personalized medicineAccess to individual patient level analysisCustomization of treatment regimes
NEW (28+)	<ul style="list-style-type: none">AI designs drugs from scratchNew classes of drugsHelp untreatable conditions	<ul style="list-style-type: none">Reimagining healthcare with AI-driven solutionsAI-powered diagnosticsVirtual assistants for HealthcareDrug discovery ecosystems	<ul style="list-style-type: none">Era of predictive medicineForecast disease trajectory for better interventionProactive healthcare paradigm



Generative AI has the Potential to Shape The Life science industry



NOW (2024-25)

CREATING CAPABILITY

Use case banks exist, proof of concepts completed and learning loop being introduced with aim to build our core GenAI capabilities.

Summarization and language techniques unlocking insights (e.g. genomics, LIMS data, new sensor data)

New **Operating Models** at enterprise



NEXT (2025-27)

AUGMENTATION

Generative AI combined with Conversational AI and Predictive AI everywhere

Co-Pilots and AI Assistants across the value chain, using custom and area-specific Multimodal Generative AI

Reengineering of key processes, incl., in molecule design and biomanufacturing



NEW (2028+)

RE-INVENTION

Augmentation to **re-invention**

Next-Generative context-aware AI-assistants fused with physical, capturing knowledge and using it experiment and enable decisions, together with people.

Fully automated labs, factories, supply nodes and customer eco-systems

Some Key Considerations and Best practice for Adoption and scale





About Capgemini

Capgemini is a global business and technology transformation partner, helping organizations to accelerate their dual transition to a digital and sustainable world, while creating tangible impact for enterprises and society. It is a responsible and diverse group of 340,000 team members in more than 50 countries. With its strong over 55-year heritage, Capgemini is trusted by its clients to unlock the value of technology to address the entire breadth of their business needs. It delivers end-to-end services and solutions leveraging strengths from strategy and design to engineering, all fueled by its market leading capabilities in AI, cloud and data, combined with its deep industry expertise and partner ecosystem. The Group reported 2023 global revenues of €22.5 billion.

Get the future you want | www.capgemini.com





Q&A

LIFE SCIENCES ACCELERATOR
FORUM

Capgemini

Reinvigorating life sciences with GenAI

**Thank you,
see you next year!**

About Capgemini

Capgemini is a global business and technology transformation partner, helping organizations to accelerate their dual transition to a digital and sustainable world, while creating tangible impact for enterprises and society. It is a responsible and diverse group of 340,000 team members in more than 50 countries. With its strong over 55-year heritage, Capgemini is trusted by its clients to unlock the value of technology to address the entire breadth of their business needs. It delivers end-to-end services and solutions leveraging strengths from strategy and design to engineering, all fueled by its market leading capabilities in AI, cloud and data, combined with its deep industry expertise and partner ecosystem. The Group reported 2023 global revenues of €22.5 billion.

Get the future you want | www.capgemini.com



This presentation contains information that may be privileged or confidential and is the property of the Capgemini Group.

Copyright © 2024 Capgemini. All rights reserved.