Artificial Intelligence And Genealogy

by Scott Lee
March 2026

Scott@ScottLee.com

www.GenealogyTechTalks.com

What You Will Learn

- How is AI used in genealogy today?
- What is AI?
- Why is AI suddenly such big news?
- A foundation of AI knowledge
- Pointers to continue learning
- Where will AI take us in the future?

Continued Education

This presentation is an introduction to using AI for genealogy research. A handout is provided with many links for continued education.

GenealogyTechTalks.com/talks/ai

AI In Genealogy Today

- Record matching
  - Ancestry.com, MyHeritage, and FamilySearch
  - These platforms use AI to suggest record matches and potential family connections based on the repositories of historical data they maintain.

AI In Genealogy Today

- Handwriting recognition
  - FamilySearch and Ancestry.com
  - These companies use AI for transcribing handwritten records. Archives and libraries around the world, like The National Archives (UK), are also adopting such technology for digitizing historical documents.

AI In Genealogy Today

- Predicting family connections
  - Ancestry.com and MyHeritage
  - These companies use predictive algorithms to suggest potential family links and to guide users towards possible research directions based on existing family tree data.

AI In Genealogy Today

- Ethnicity in DNA analysis
  - 23andMe, AncestryDNA, and others
  - These companies use AI to analyze genetic data, providing insights into ethnicity and ancestral origins. This analysis includes percentage breakdowns of heritage from various regions around the world.

AI In Genealogy Today

- Improved search results
  - GenealogyBank, Newspapers.com, and others
  - These websites use AI to tailor search results and suggestions based on user interactions and previous searches.

AI In Genealogy Today

- Handwriting recognition
  - Archaic, hard to read handwriting
  - Translate foreign languages
  - Fuzzy, damaged images
- “Scan” a document with a simple camera
  - No need to place on flat glass
  - Reconstruct torn and crumbled documents

What is Artificial Intelligence?

- Computer emulation of human behaviors
- Threshold of “modern” AI rises over time
  - Some consider AI before “deep learning neural networks” to just be clever programming
- Powerful AI always 10 to 20 years away
  - Until 2012 when three technologies came together

History of AI

- 1950 Alan Turing: the Turing Test
- 1955 John McCarthy: coined the term AI
- 1966 Joseph Weizenbaum: ELIZA Chatbot
- 1986 Geoffrey Hinton: backpropagation
- 2012 Geoffrey Hinton: AlexNet

Levels of AI

- Artificial Narrow Intelligence (ANI)
  - Focuses on one narrow task
  - Emulates one behavior of a human
  - State of the art today
- Artificial General Intelligence (AGI)
  - Ability to “understand”
  - Can learn any task that a human can do
  - The “singularity”
  - Years away?

Why is AI in the news lately?

- Increase in computer processing power
- Old “failed” designs now work with more compute power
- Neural networks require massive compute power to train
  - Not practical until early 2010s

AI In Chess

- 1997: Deep Blue defeated Garry Kasparov
- Created by IBM
- Deep Blue looked ahead more moves
- No new strategies resulted

AI In Go

- 2017: AlphaGo beat Ke Jie
- Created by DeepMind (now owned by Google)
- AlphaGo's strategies are still studied today
- Later versions: AlphaZero and MuZero
- MuZero is also the world’s best at chess, checkers, and other games

How Does MuZero Learn?

- Figures out the rules
- Figures out what winning means
- Figures out strategies to win

What Happened In Those 20 Years?

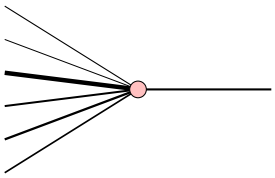
- Chess in 1997: Procedural programming
- Go in 2017: Neural Network
- Humans stopped designing
- Let AI figure out on its own

Neural Network

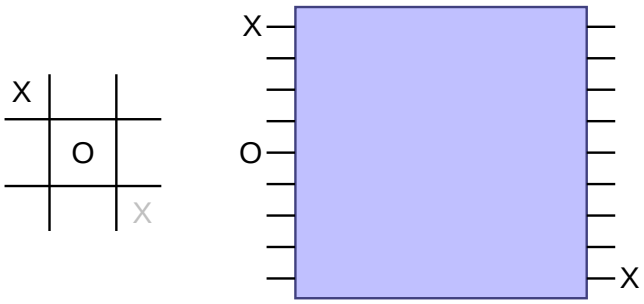
- A computer program that simulates a group of neurons
- Inspired by studying human brains

A Neuron

- Many inputs with weighting factors
  - (Also, bias, activation functions, and other details)
- One output

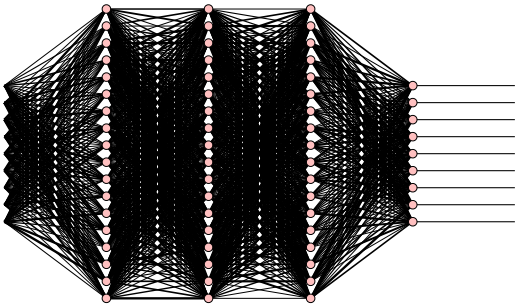


Tic-Tac-Toe



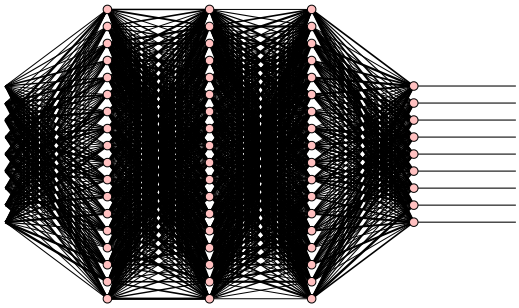
Deep Learning Neural Network

- We don't know why it works
- Tic-Tac-Toe (learns rules, derives strategy)



Training/Learning

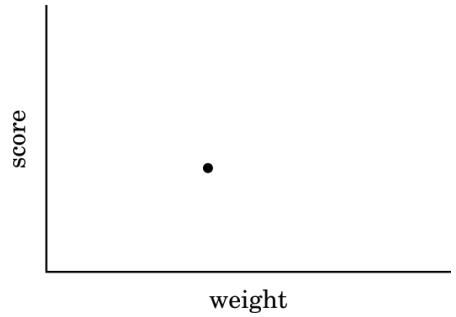
- The process of picking better weighting factors



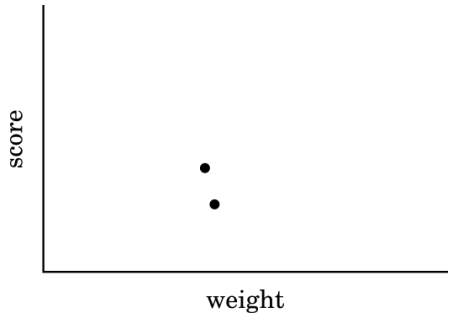
Training/Learning

- First, Randomly assign weighting factors
- Run the network
- Calculate a score
- Make small adjustments to weighting factors
- Run the network again
- Repeat the process many, many, many times

Training/Learning



Training/Learning



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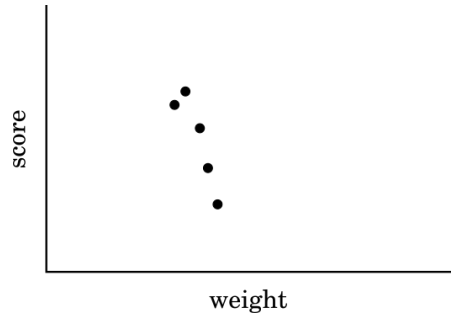

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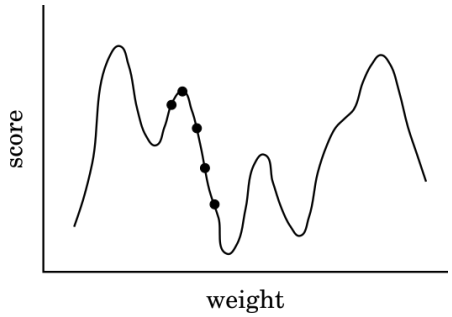
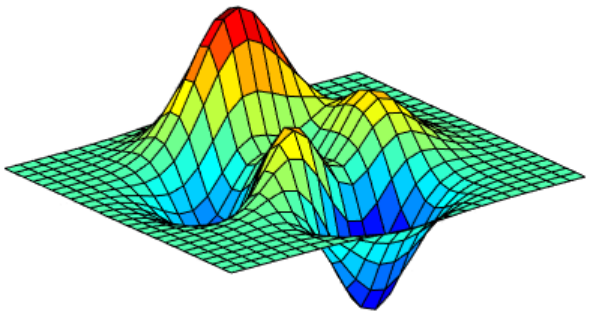
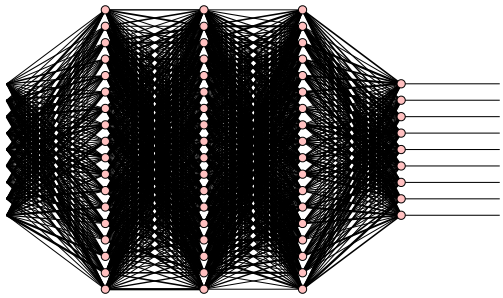


Training/Learning



Training/Learning

- (9x18)+(18x18)+(18x18)+(18x9)=972



Backpropagation

- “Finding the slope”
- Adjust weighting factors more efficiently
- Find slope at current position
- Uses differential multivariate calculus
- Takes longer, but better adjustments

Compute Power

- Add, subtract, multiply, divide
- Training requires massive power
- Using takes much less power
- GPUs (Graphics Processing Units)
  - Originally for 3-D graphics (video games)

GPUs

- TeraFLOPS or TFLOPS
  - Tera FLoating-point Operations Per Second
  - Trillions Per Second
- 1996: first 1 TeraFLOP supercomputer
- Modern GPU: 10s to 100s of TeraFLOPs
- Jensen Huang, NVIDIA CEO, March 2022:
  - 1 million times speedup in the coming decade
  - A bold prediction (likely unreachable)
  - (ZettaFLOPS or YottaFLOPS)

Enabling Breakthroughs

- Deep learning neural networks
- Backpropagation
- Multi-TeraFLOP GPUs

Neural Networks vs. Brain

- GPT-4: about 0.1-2 trillion parameters
- Human brain: about 100-1000 trillion synapses

Large Language Models (LLM)

- ChatGPT, Claude, DeepSeek, Gemini, etc.
- Trained on text from the Internet
  - Every page of Wikipedia, and lots more
- Next word prediction
  - Once upon a …
- “Most probable word” is not always “truth”
- Doesn’t “understand” the way we do

Generative Adversarial Networks (GANs)

- Generator: e.g., generate pictures of faces
- Discriminator: e.g., detect fake pictures
- Put together, they improve each other

Why Do Neural Networks Work?

- We don't know!
- There are many theories
- "Any sufficiently advanced technology is indistinguishable from magic."
  -- Arthur C. Clarke, 1962

Learn To Use AI

- It's here to stay
- It can make your life easier
- Think of it as a knowledgeable friend
- Think of it as an advisor
- Use it in research and in daily life

Using LLMs In Research

- Can teach you the basics of genealogy
- Turn you dry facts into an engaging story
- Translate languages
- Recommend next records to search
- Explain legal and archaic terminology
- Advice on "brick walls"

Using LLMs In Research

- Use Perplexity for searching the web
  - A search engine with an LLM to summarize
  - It sites its sources (fewer hallucinations)
- Use NotebookLM to analyze documents
  - Upload the documents
  - It constructs answers from only those documents (fewer hallucinations)

Using LLMs In Research

- Use other LLMs for general tasks
  - ChatGPT, Claude, Gemini, etc.
- Most are now multi-modal
  - Can generate images and videos
  - Can search the web and use specialized tools

Using LLMs In Research

- Most now offer multi-level “reasoning models”
  - For example, Fast, Thinking, and Pro
  - Some not be available in the free version
- Generate multiple possible answers
  - Then ask which is the best
- Ask itself “steps to answer this question”
  - Run each step (multiple times, asking for best)
  - Reevaluate if this is a good answer

Using LLMs Every Day

- Composing email
- Adapting recipes in the kitchen
- Explaining medical concepts and terms
- Troubleshooting technical problems
- Recommending movies you may like
- Planning a vacation
- Advising on home repairs

How to Master AI Use

- “Play” with AI for 20 hours
  - Ask it genealogy questions
  - Ask it every day questions
- Then start watching videos in my handout
  - About 8 hours of video on genealogy
  - About 1 hour on AI technology (optional)
- After 6 to 12 months you will be there

AI In the Near Future

- Automatically Label people in old photos
- Construct a 3-D face from multiple photos
- Repair a photo by using other pictures of that person
- Date a photo
  - Judge the age of people in the photo
  - Consider objects in the background
  - Identify clothing styles

AI In the Near Future

- Verify your tree with DNA
- Use DNA to suggest missing ancestors
- Suggest searches to extend your tree
- Find insufficiently documented parts of trees

AI In the Near Future

- Generate narrative family histories
  - Transform dry data into engaging stories
  - Make it compelling and personalized
  - Add contextual historical information

AI In the Near Future

- Automated Research Assistant
  - Like a professional genealogist sitting next to you
  - Suggest highly tailored research strategies
  - Remember where you have already looked
  - Recognize gaps in your knowledge and educate you

AI In the More Distant Future

- Find newspaper articles about ancestors
  - Your grandmother attended a birthday party
  - Your cousin visited another relative
- Build lists of an ancestor's friends, associates, and neighbors (the FAN club)
- Automatically build your tree
  - Find sources automatically
  - Use DNA to verify and adjust
- Change genealogy from research to ...

Handouts

- Slides, links, and glossary: GenealogyTechTalks.com/talks/ai
- Use the links to continue your education on AI