Empowering AANHPI Health & Wellness

Artificial Intelligence Primer

About This Presentation

- AI as seen through the lens of
  - Science
  - Engineering
  - Technology Advocacy
- Information and perspectives are solely my own and do not represent the views or positions of my current employer or any other organization with which I am affiliated.

About John Ano

- Born and raised in Honolulu
- Punahou Class of ‘83
- Bachelor of Science in Psychology, Oregon State
- 40+ years in the software industry: Dev, IT, management
- Artificial Intelligence and Machine Learning engineer (large language models, voice synthesis)

Empowering AANHPI wellness with AI: Knowledge Is Power

- Gain a deeper understanding of how modern AI works
- Understand how to use AI tools to inform, assist and guide providers and individuals on important health topics
- Use facts and knowledge to counteract anxiety and distrust of AI
- Protect yourself: Understand and manage risk when using AI

Section Topics

- Intro to Artificial Intelligence: How modern AI works
- Getting the most out of AI chatbots
- Protecting private information when using AI
- Future opportunities and application for AI

Ekahi

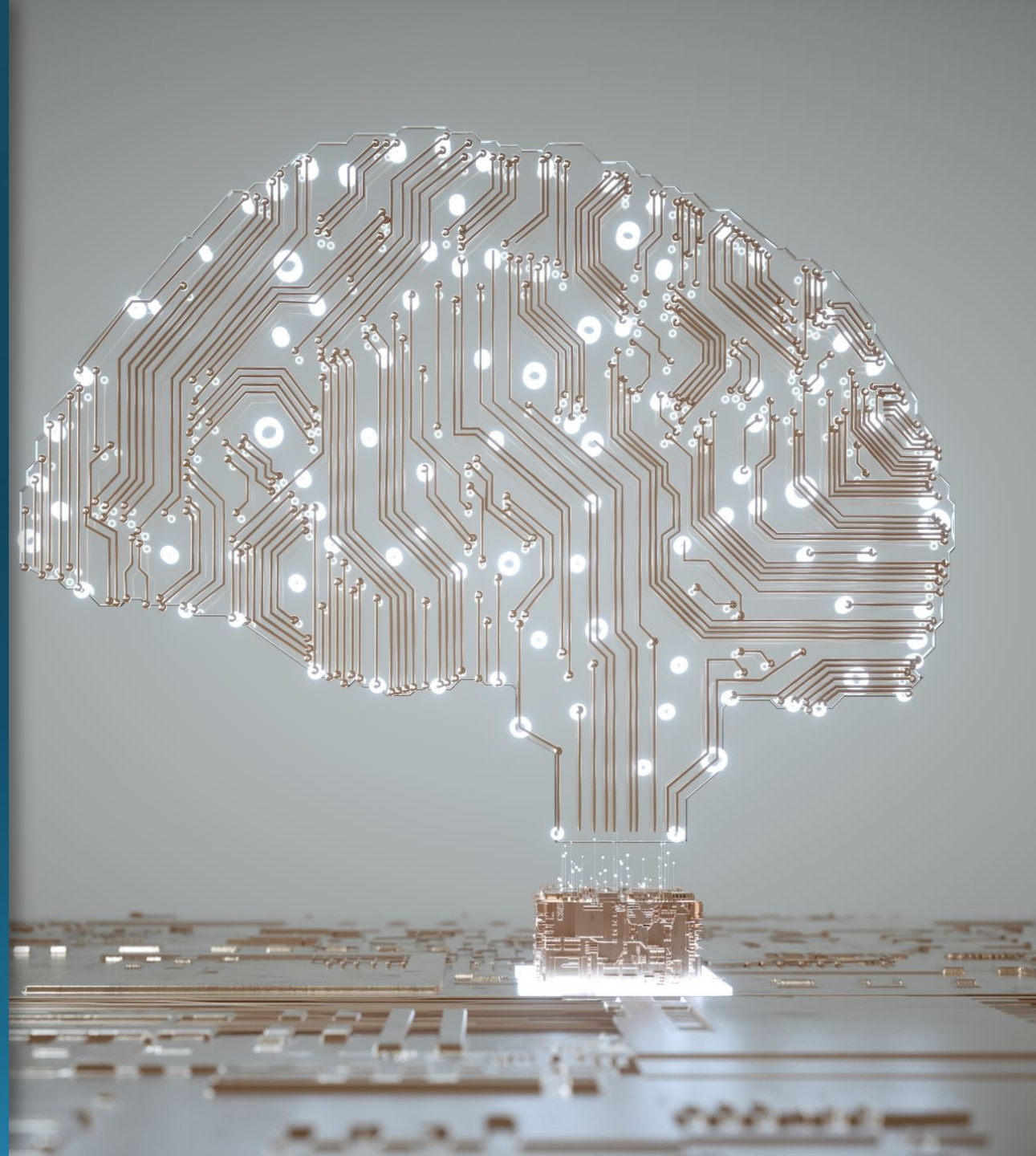
How AI Works

Modern AI in a nutshell

- AI systems like ChatGPT are artificial neural networks that emulate or mimic the way our brain cells (also called nerve cells or neurons) learn and retain information.
- This mimicry is possible through math models implemented as computer code
- That AI computer code needs to run on our most powerful computers designed to perform massively parallel computations
- **For all of that technical wizardry, AI as we know it today would not exist without our brains as a blueprint.**

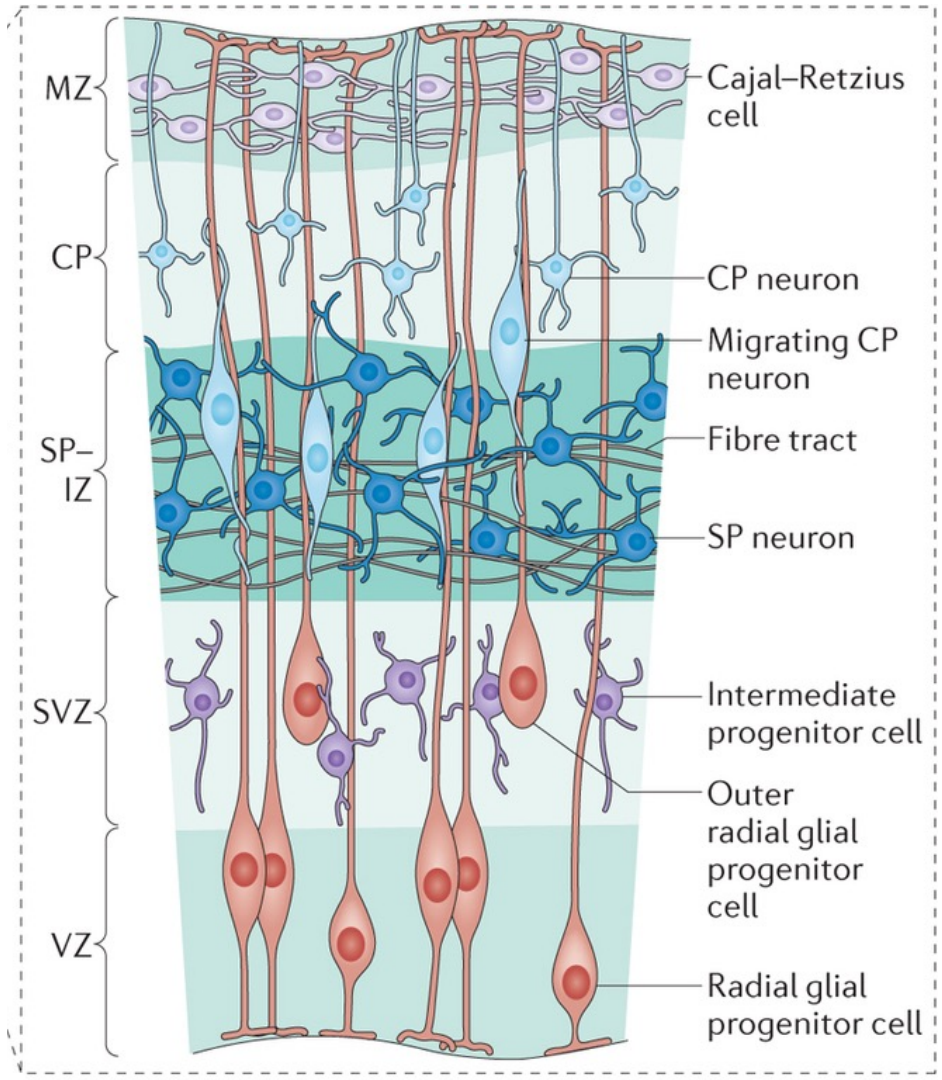
No AI without BRAIN

- The fundamental principles of modern AI are modeled after the behavior and properties of biological neurons (brain cells).
- Artificial neural nets are math models built with matrix algebra and calculus
- Both neuron types learn through connection adaptation over time



Neurons of the human cerebral cortex

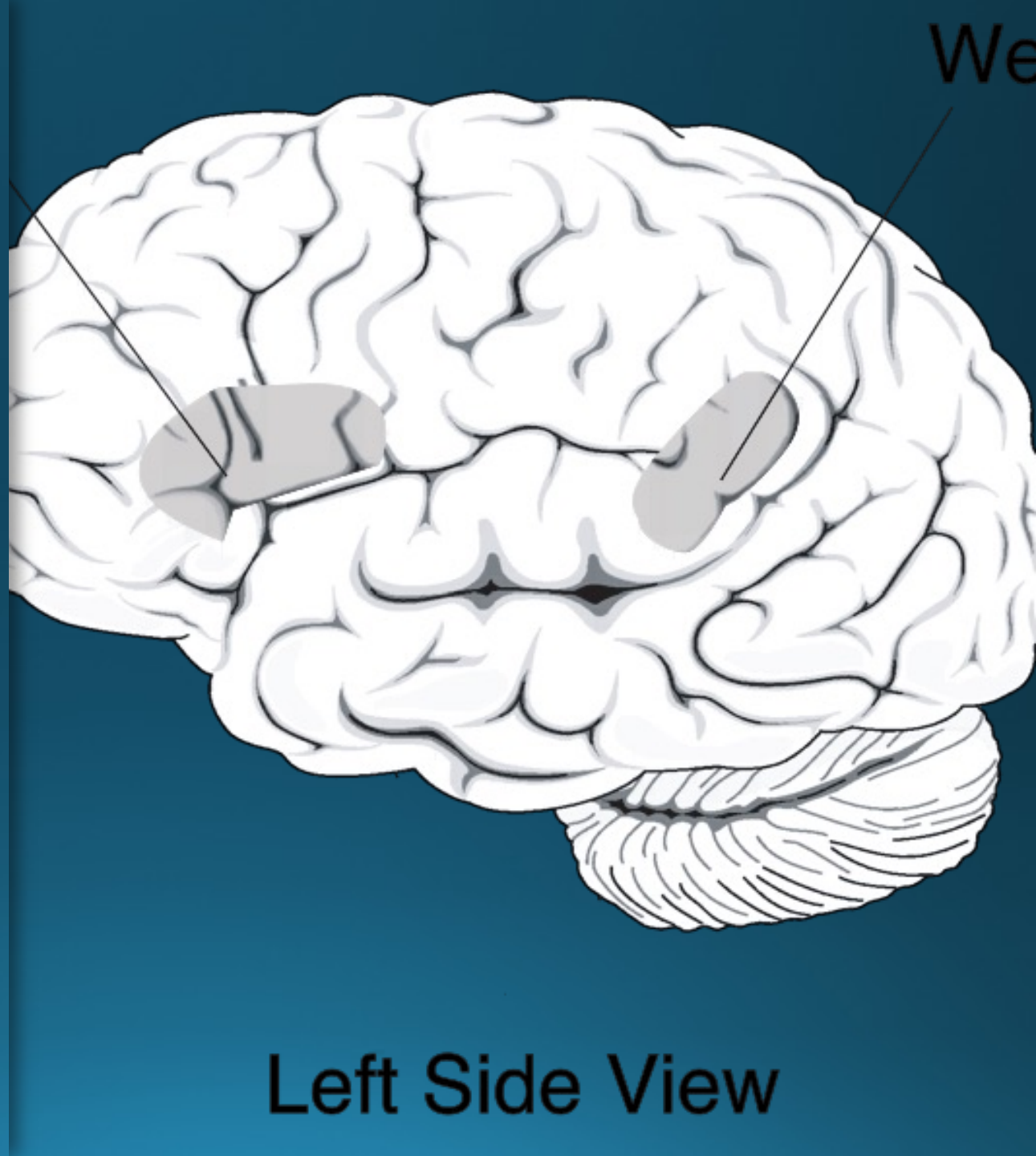
- Associated with abstract thought
- found in the frontal lobes
- six **layers** of distinct types



Nature Reviews | Neuroscience

Fun facts about Human Neural Language Processing

- Broca's area: The language center of the brain that processes grammar, speech production
- Wernicke's processes spoken/written language and interpretation of meaning
- Broca's area and Wernicke's area of the left frontal parietal lobe are roughly the size of a Chicken McNugget.
- Broca's area is thought to be 20% larger in female brains.

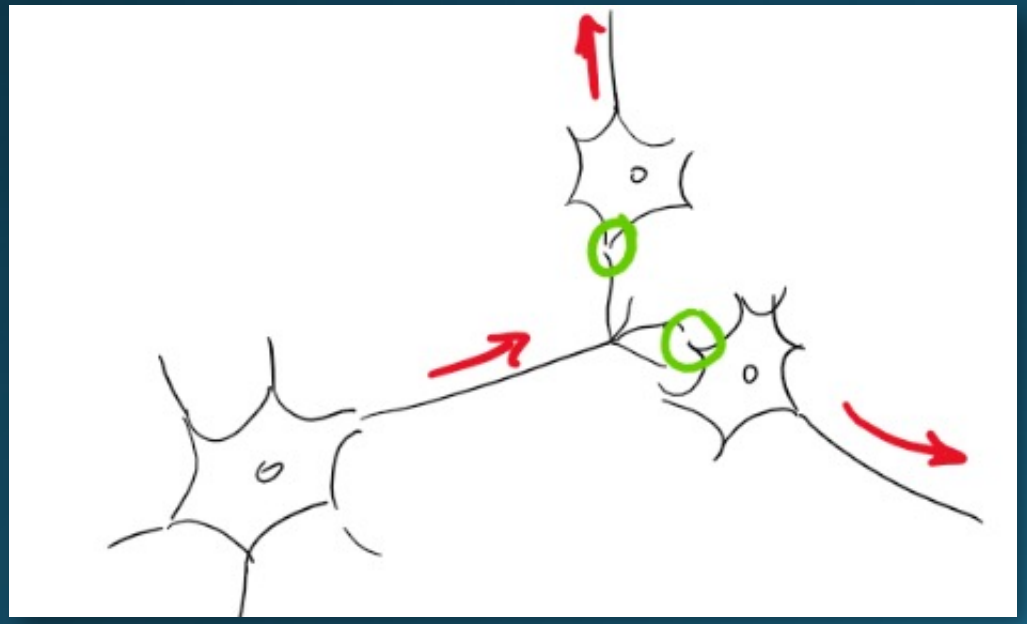


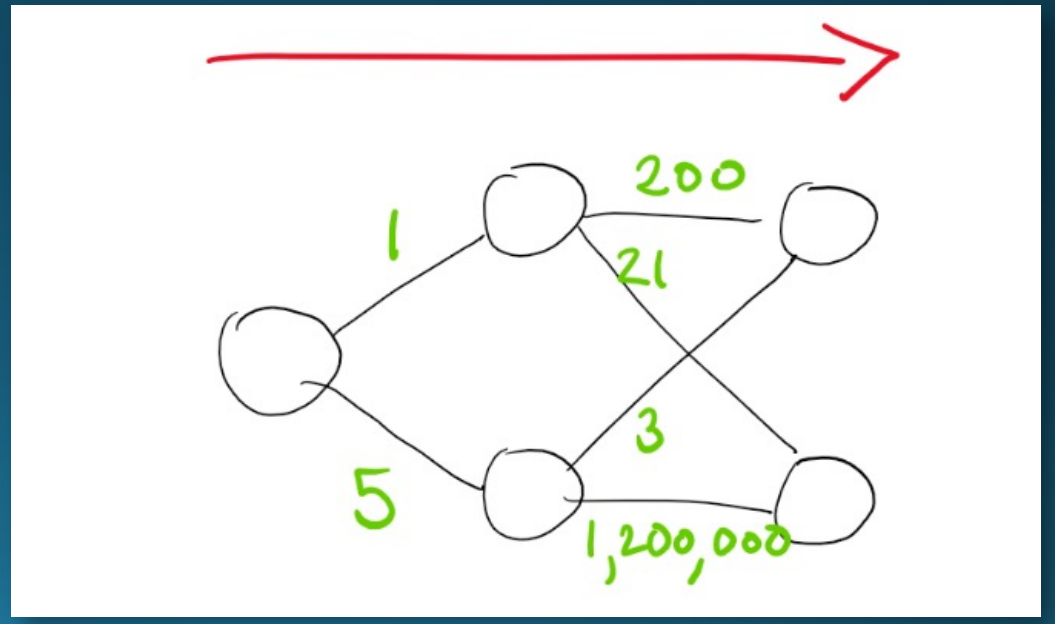
from biology to math models

Neurons that fire together wire together

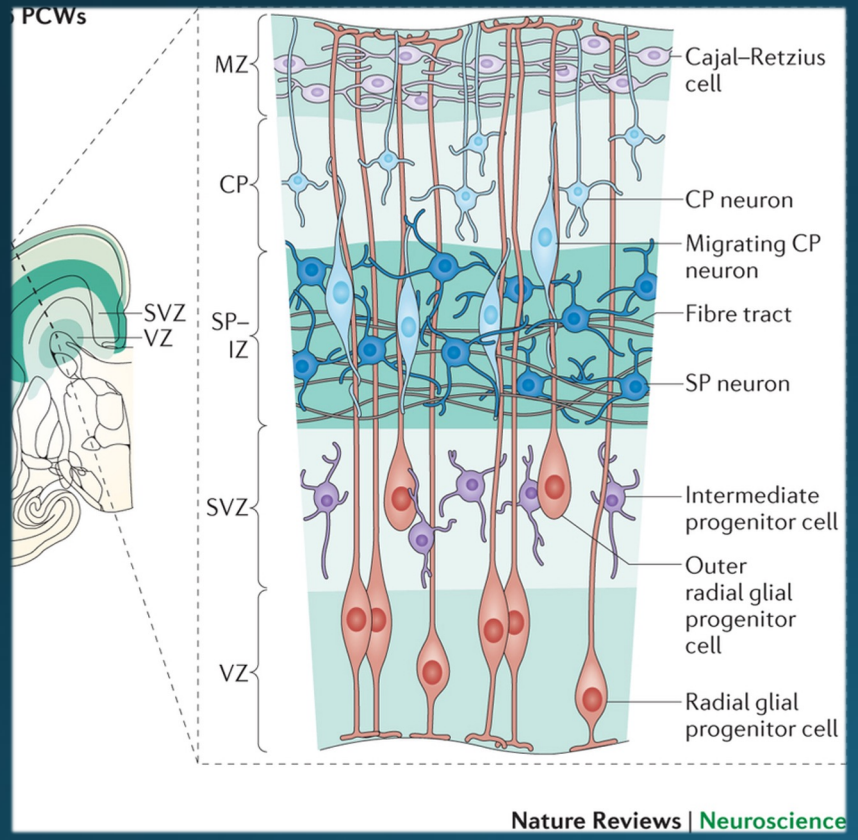
"Let us assume then that the persistence or repetition of a reverberatory activity (or "trace") tends to induce lasting cellular changes that add to its stability. The assumption* can be precisely stated as follows: When an axon of cell A is near enough to excite a cell B and repeatedly or persistently takes part in firing it, some growth process or metabolic change takes place in one or both cells such that A's efficiency, as one of the cells firing B, is increased."

HEBB, D.O.. THE ORGANIZATION OF BEHAVIOR (1949). TAYLOR AND FRANCIS. KINDLE EDITION.





The brain is modeled with math



Learn: encode inputs into the connections

$$z_j^{[l]} = \sum_{i=1}^{n} W_{ji}^{[l]} a_i^{[l-1]} + b_j^{[l]} \qquad a_j^{[l]} = g^{[l]}(z_j^{[l]})$$

Compute the output error

$$\delta_j^{[L]} = \frac{\partial \mathcal{L}}{\partial a_j^{[L]}} \cdot g'^{[L]}(z_j^{[L]}) \qquad \delta_j^{[l]} = \left(\sum_{k=1}^{m} W_{kj}^{[l+1]} \delta_k^{[l+1]} \right) \cdot g'^{[l]}(z_j^{[l]})$$

Adjust connection weights

$$\frac{\partial \mathcal{L}}{\partial W_{ji}^{[l]}} = a_i^{[l-1]} \delta_j^{[l]} \qquad \frac{\partial \mathcal{L}}{\partial b_j^{[l]}} = \delta_j^{[l]}$$

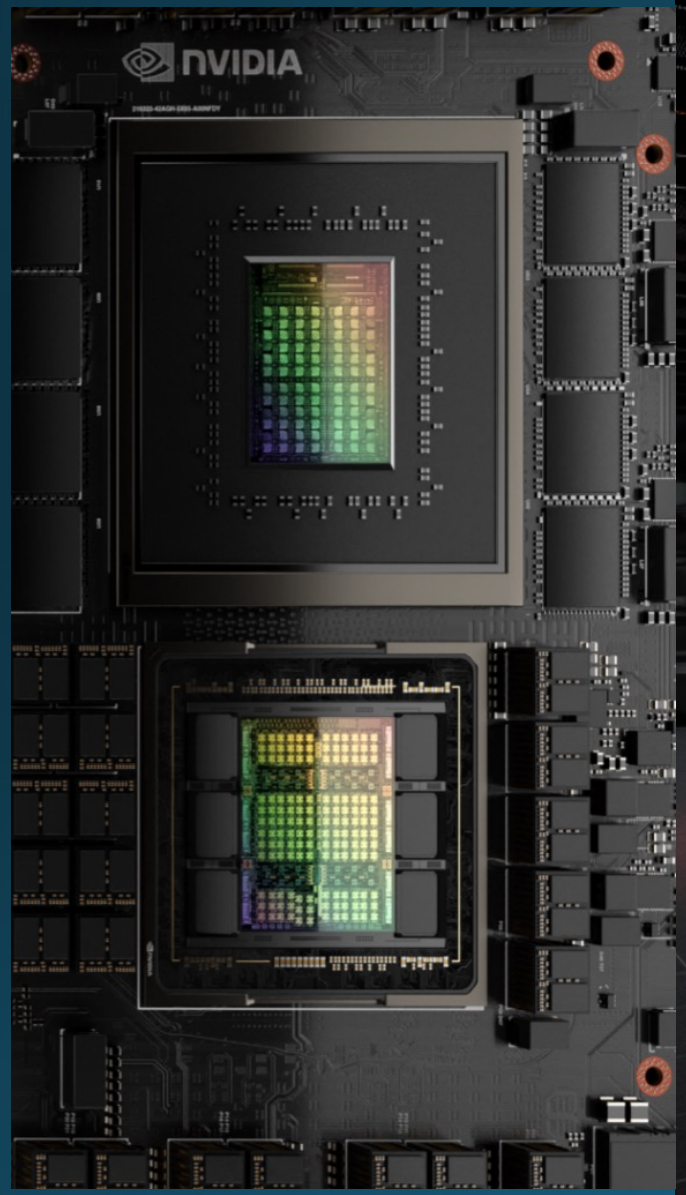
Learn (forward pass)

$$z_j^{[l]} = \sum_{i=1}^{n} W_{ji}^{[l]} a_i^{[l-1]} + b_j^{[l]} \quad a_j^{[l]} = g^{[l]}(z_j^{[l]})$$

```
class TransformerModel(nn.Module):
    def __init__(self, ntoken: int, d_model: int, nhead: int, d_hid: int,
                 nlayers: int, dropout: float = 0.5):
        super().__init__()
        self.model_type = 'Transformer'
        self.pos_encoder = PositionalEncoding(d_model, dropout)
        encoder_layers = TransformerEncoderLayer(d_model, nhead, d_hid, dropout)
        self.transformer_encoder = TransformerEncoder(encoder_layers, nlayers)
        self.embedding = nn.Embedding(ntoken, d_model)
        self.d_model = d_model
        self.linear = nn.Linear(d_model, ntoken)
        self.init_weights()

    def init_weights(self) -> None:
        initrange = 0.1
        self.embedding.weight.data.uniform_(-initrange, initrange)
        self.linear.bias.data.zero_()
        self.linear.weight.data.uniform_(-initrange, initrange)

    def forward(self, src: Tensor, src_mask: Tensor = None) -> Tensor:
        """
        Arguments:
            src: Tensor, shape ``[seq_len, batch_size]``
            src_mask: Tensor, shape ``[seq_len, seq_len]``
        Returns:
            output Tensor of shape ``[seq_len, batch_size, ntoken]``
        """
        src = self.embedding(src) * math.sqrt(self.d_model)
        src = self.pos_encoder(src)
        output = self.transformer_encoder(src, src_mask)
        output = self.linear(output)
        return output
```


NVIDIA

Comparisons

Specs	GPT-3 (estimated)	ChatGPT-4 (estimated*)	Humans (estimated)
Total Neurons	7.5 million units	85 million units	86 billion
Neurons for cognitive processes	N/A	N/A	16-20 billion
Neurons for language processing	7.5 million units	85 million units	100's of millions to several billion
Parameters/Connections Total	175 billion	Up to 2 trillion	100 trillion to 1 quadrillion (1000 trillion)
Parameters/Connections for all cognitive processes	175 billion	Up to 2 trillion	100 trillion (guestimate)
Parameters/Connections for language processing	175 billion	Up to 2 trillion	100 trillion (guestimate)

*OpenAI models are proprietary and estimates are speculation based on extrapolation from smaller models and reverse engineering analysis by outside parties

AI Primer Summary

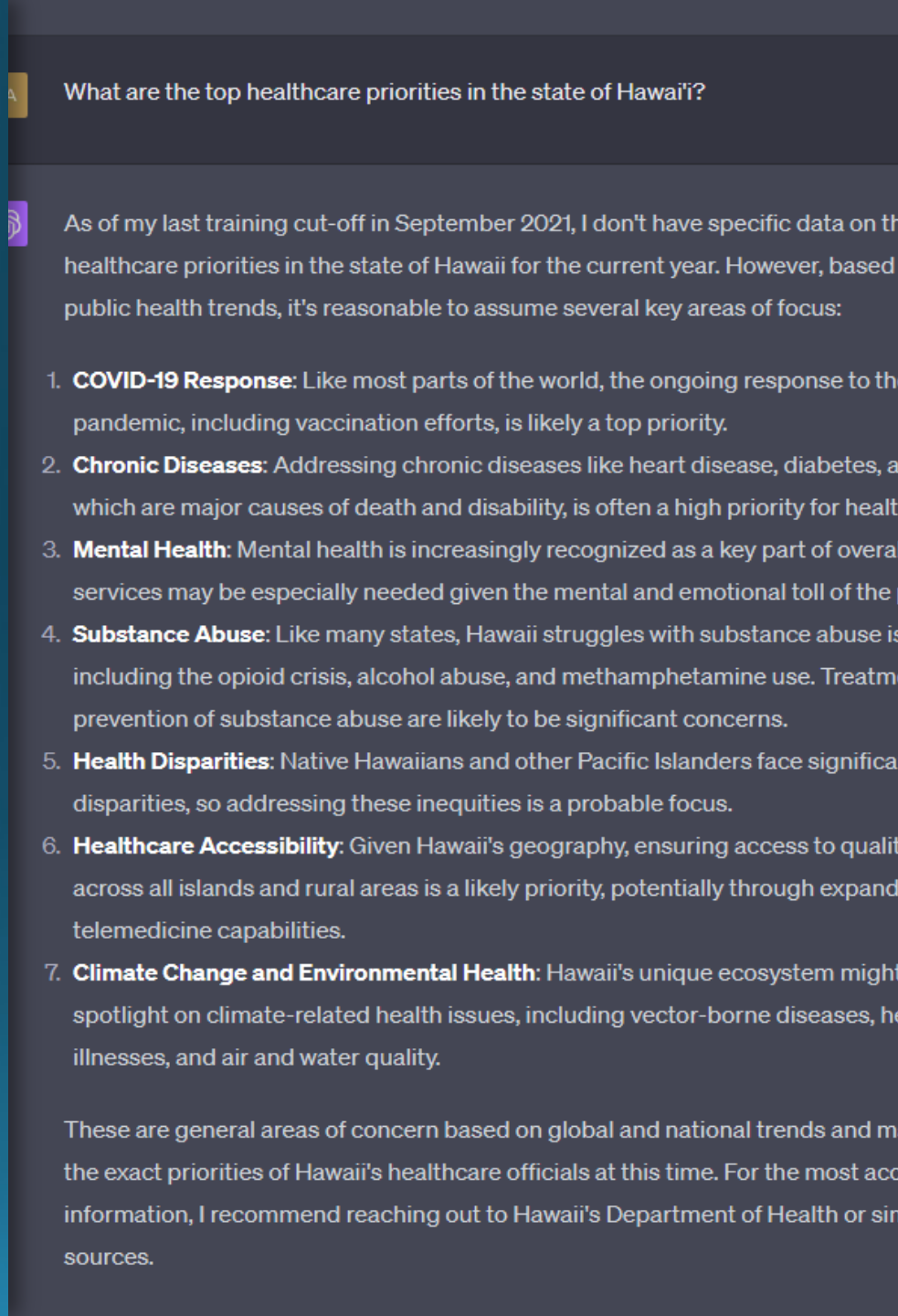
- AI is modeled after the way biological neurons operate to enable learning and memory
- AI encodes everything it learns in the connections between artificial neurons
- AI models are mathematically based
- Math models are implemented as computer programming code
- Entire datacenters of specialized hardware (GPUs) are needed to meet the massive computational needs of modern AI
- Our brains are still way bigger, more complex and smarter! (for now)

Elua

Use AI Like A Pro

The Art Of The Prompt

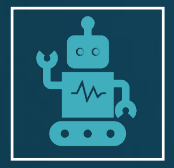
- Prompts are the questions or queries you pose to AI like ChatGPT, Bing, Bard, Claude.ai and others.
- Write your prompts in plain English
- English Majors: Rejoice, and rise up!
- Practice makes perfect



Effective Prompting Techniques

- Make chatbots explain and summarize complicated or new topics:
  - "Can you help me understand …?"
  - "I don't understand what [some term|phrase|topic] means. Can you summarize it for me?"
- Ask for details
  - "Tell me as much as you know about [some topic]"
- Ask for key points you should know:
  - "What are the most important things I should know about …?"
- Ask for examples:
  - "I want to learn more about [something]. Can you show me examples of …?
- Ask for comparisons:
  - "What are the different [options|versions|perspectives] …?"
  - " How do these differ and how are they similar?"
- Chain your questions in the conversation
  - AI chatbots have a limited memory of recent Q&A in your conversation
  - It can recall recent conversation to stay "in context" for follow on Q's
  - Start general and drill into specifics
  - Over long conversations AI may "forget" your earliest questions

Scrutinize Everything



All AI chatbots are trained on various data from the internet, scholarly articles, e-books, etc.

No AI has all the information on every topic.

This means that bias exists in every AI knowledge base

- Do fact check chatbot information you plan to use
- Use search engines to double-check (even triple-check).
- Ask the same questions to multiple AI systems:
  - ChatGPT
  - Bard
  - Bing
  - Claude.ai

AI Hallucinations and Misinformation

- AI can generate factually incorrect, misleading and potentially harmful information.
- Hallucinations are a side-effect of the training data and the AI model's design.
- We are in the very early days of mainstream AI adoption, and change is occurring rapidly.
- Rapidly changing new technology…what could go possibly wrong? ☺
- Scientists, engineers and business are working hard to better understand this phenomenon to address this issue.

Ekolu

Data Privacy and AI

Protect your privacy and personal data

- Chatbot conversations can be used to train future AI models
- Minimize sharing personally identifiable information when using AI
- Understand the corporate terms and conditions of data usage by AI
- You have the right to **opt out of data sharing** if you are concerned about how your data could be used

Eha

The Road Ahead

Future AI Directions for AAHNPI

- Fine-tune AI for AANHPI domain knowledge
  - AI trained specifically on knowledge important to this community
  - Use AI to perpetuate our cultural knowledge, values and principles
  - Build AI agents to support administrators, providers and individuals
- Wearables Integration with AI
  - Health, Fitness and Wellness
- Education and Advocacy
  - Inform all generations of people in the community
  - Develop educational programs to build knowledge of AI
  - Focus on the youngest generations because they will not know a life without AI

Pau Hana

Mahalo!