



QUEEN'S COLLEGE *of*  
BUSINESS, TECHNOLOGY & PUBLIC SAFETY

# Introduction to the course

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# Bio and Disclosure

## **Education**

- MSc Advanced Biomedical Science
- Dip Data Science and Machine Learning

## **Professional Experience**

- IT Business / Data Analyst experience in pharmaceutical industry
- Teaching experience on Machine Learning and AI
- Extensive experience in SQL, Data Science with Python

# Get to Know the Class

What is your name?

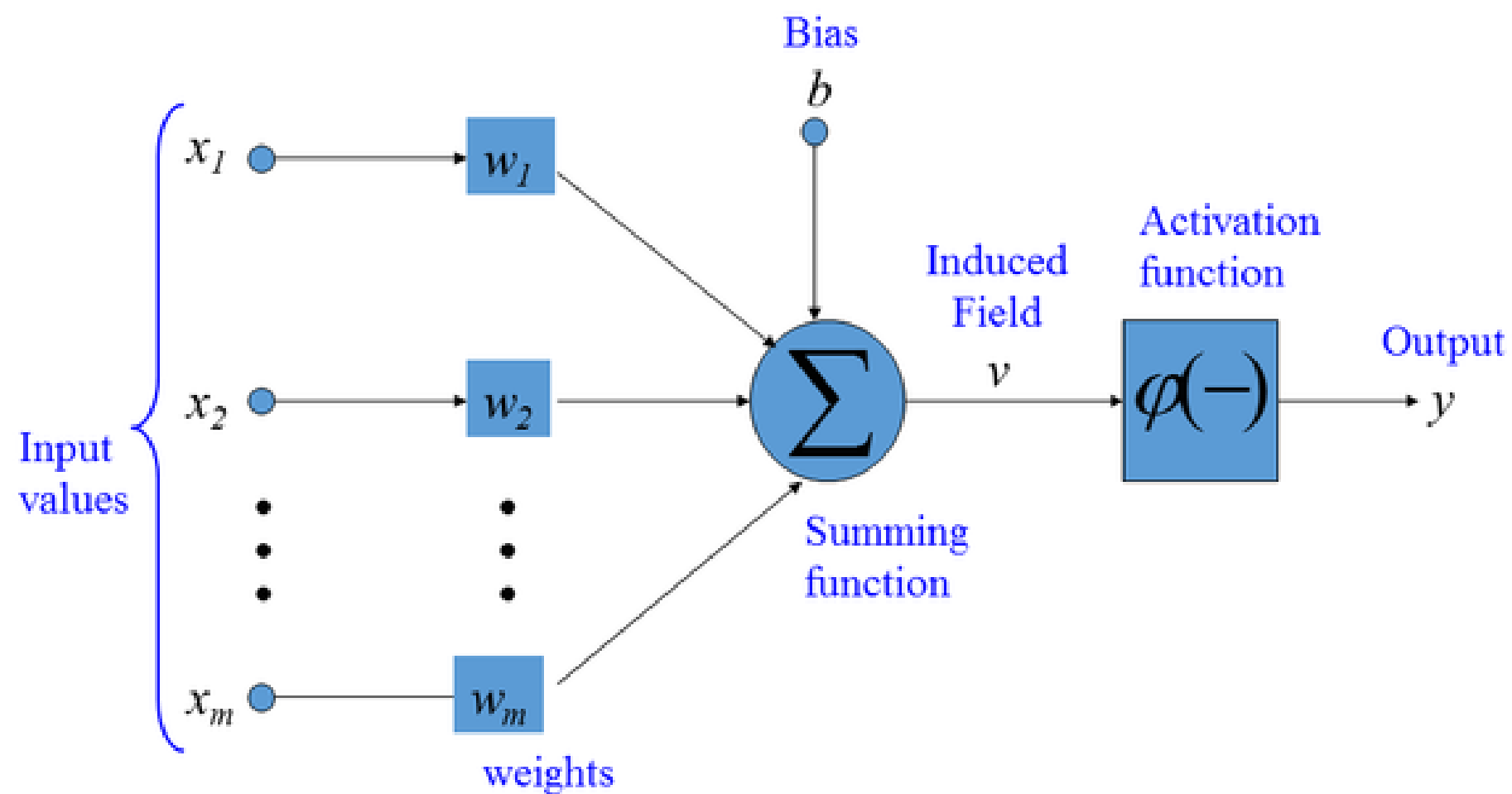
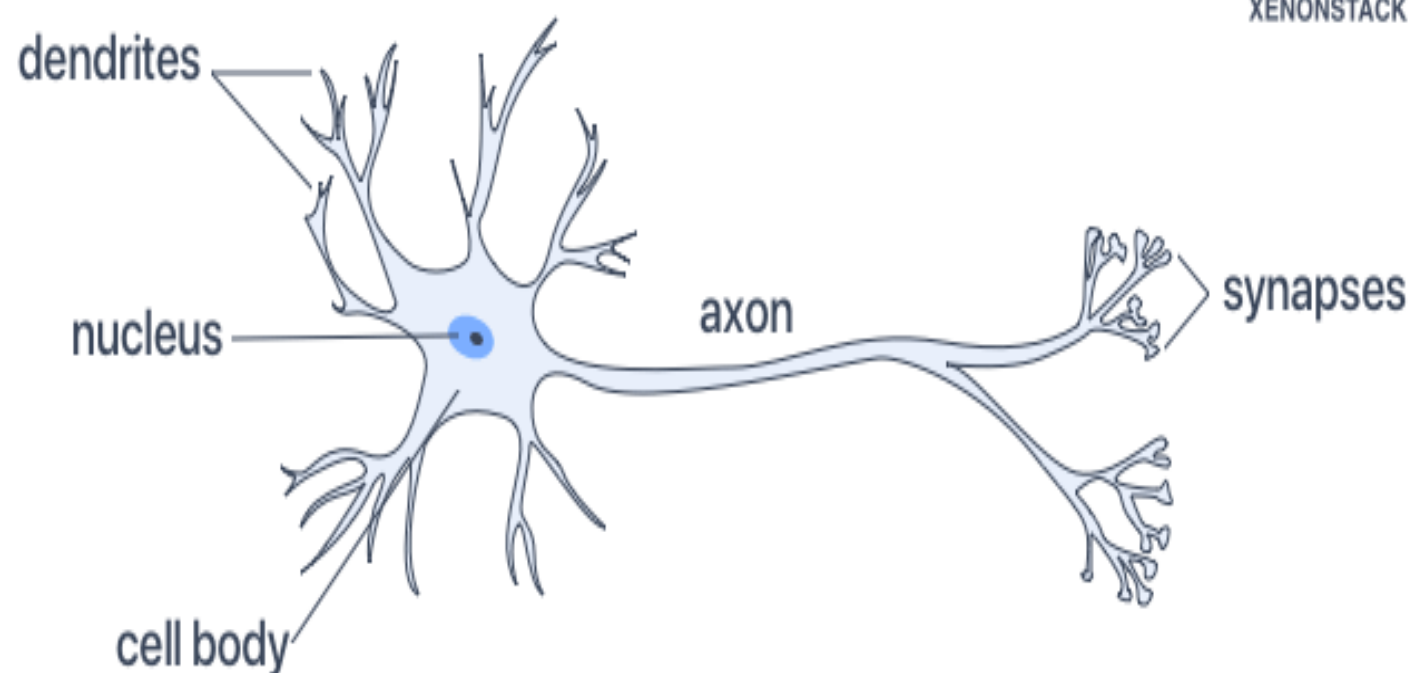
What do you do for living?

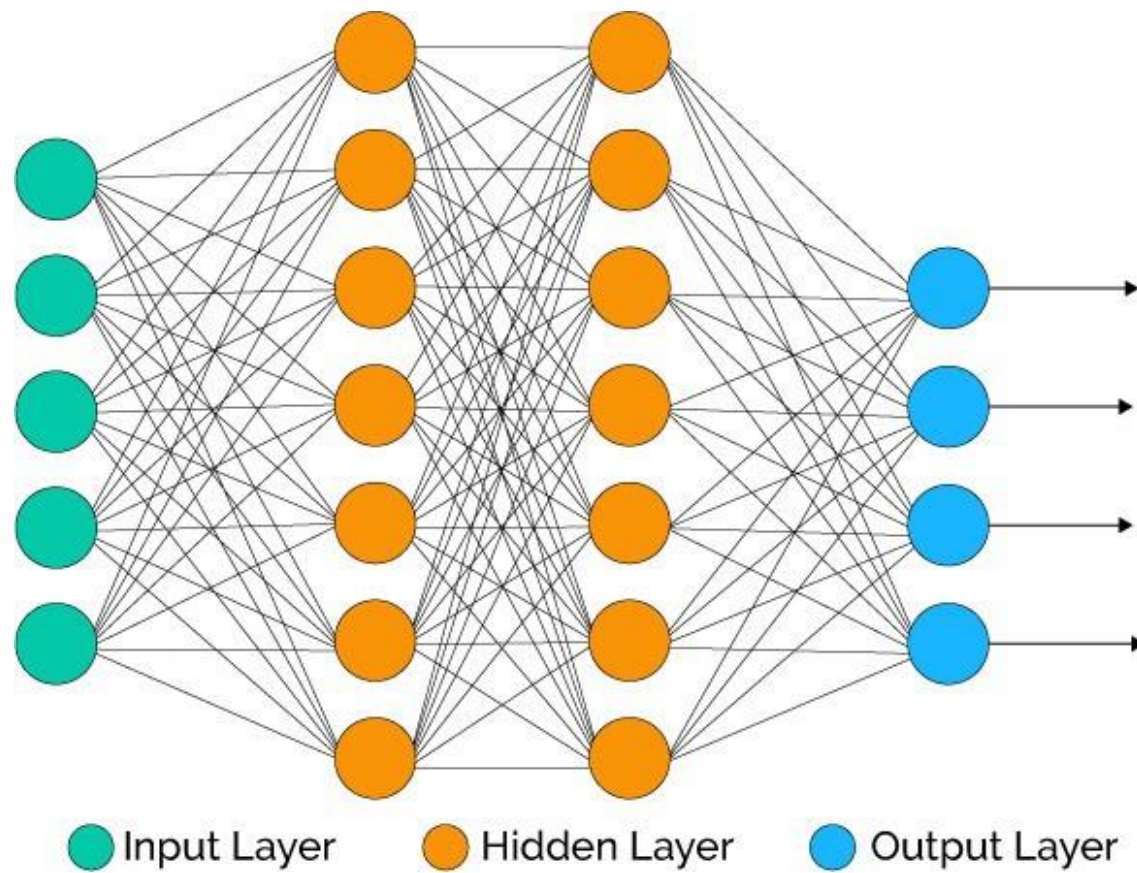
Or are you still studying at school for full time?

Why do you take the course?

**What do you know  
about Neural  
Networks?**

## Biological Neuron





**Deep Neural Network**

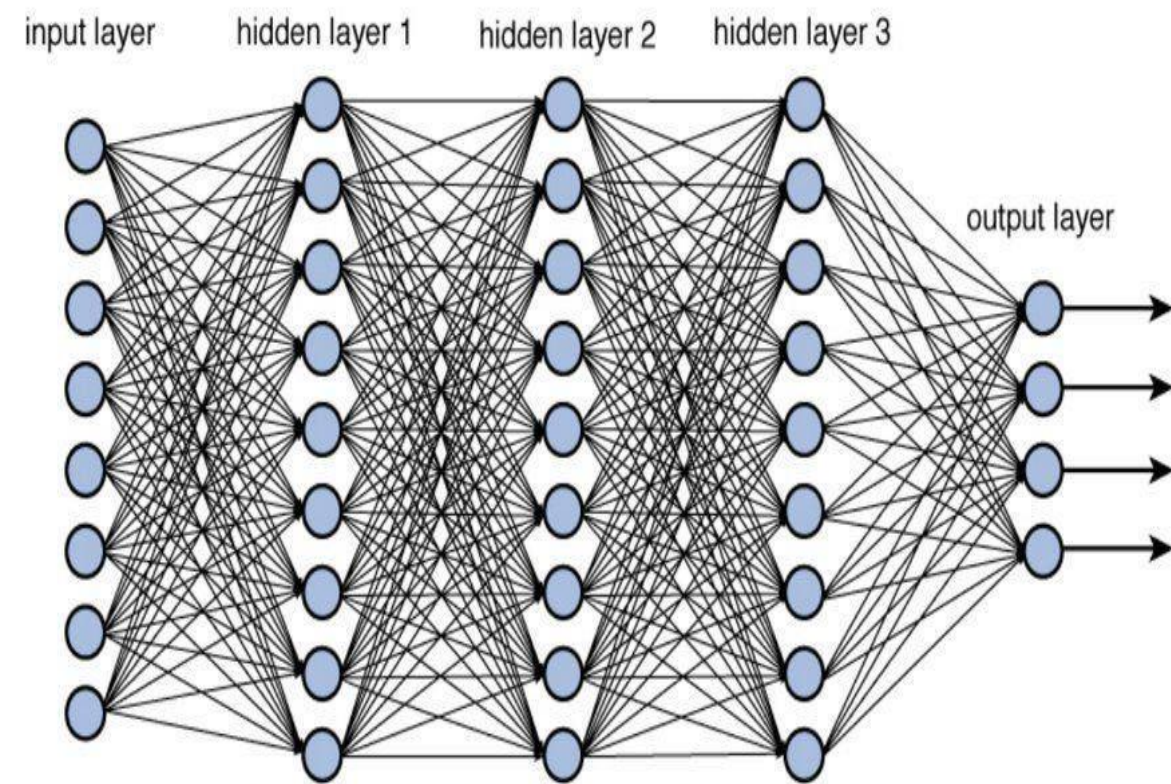


Figure 12.2 Deep network architecture with multiple layers.

# Introduction to Neural Networks and Deep Learning

- ✓ ***What are neural networks?***
- ✓ ***What constitutes deep learning?***



## Theme of this Course

- **Neural Networks**
- **Artificial Science**
- **Data Science and Analytics**



- ❑ Neural networks are a set of algorithms, modeled loosely after the human brain, that are designed to recognize patterns.
- ❑ They interpret sensory data through a kind of machine perception, labeling or clustering raw input.
- ❑ The patterns they recognize are numerical, contained in vectors, into which all real-world data, be it images, sound, text or time series, must be translated.



## Humans Versus Computers: Stretching the Limits of Artificial Intelligence

### DIFFERENCE BETWEEN HUMAN BRAIN AND COMPUTER

Biological neurons or  
nerve cells

200 billion neurons, 32  
trillion interconnections

Neuron size: 10-6m

Energy consumption: 6-10  
joules per operation per sec

Learning capability



Silicon transistors

Few billion bytes RAM,  
trillion of bytes on disk

Single transistor size: 10-9m

Energy consumption: 10-16  
joules per operation per second

Programming capability

## Humans Versus Computers: Stretching the Limits of Artificial Intelligence

- ❖ Humans and computers are inherently suited to different types of tasks.
- ❖ For example, computing the cube root of a large number is very easy for a computer, but it is extremely difficult for humans.
- ❖ On the other hand, a task such as recognizing the objects in an image is a simple matter for a human but has traditionally been very difficult for an automated learning algorithm.

- Only a limited amount is known about how the brain truly works.
- Therefore, it is fair to suggest that the biologically inspired success of convolutional neural networks might be replicated in other settings, as we learn more about how the human brain works



## Why Neural Networks?

- ❖ A key advantage of neural networks over traditional machine learning is that the former provides a higher-level abstraction of expressing semantic insights about data domains by architectural design choices in the computational graph.
- ❖ The second advantage is that neural networks provide a simple way to adjust the complexity of a model by adding or removing neurons from the architecture according to the availability of training data or computational power.
- ❖ A large part of the recent success of neural networks is explained by the fact that the increased data availability and computational power of modern computers has outgrown the limits of traditional machine learning algorithms, which fail to take full advantage of what is now possible.

## Neural Networks and your Daily Life.

- ❖ The “big data” era has been enabled by the advances in data collection technology; virtually everything we do today, including purchasing an item, using the phone, or clicking on a site, is collected and stored somewhere.
- the development of powerful Graphics Processor Units (GPUs) has enabled increasingly efficient processing on such large datasets (Big Data).
- These advances largely explain the recent success of deep learning using algorithms that are only slightly adjusted from the versions that were available two decades back.

## What is possible?

The rapid advances associated with the three pillars of improved data, computation, and experimentation have resulted in an increasingly optimistic outlook about the future of deep learning.

By the end of this century, it is expected that computers will have the power to train neural networks with as many neurons as the human brain.

Although it is hard to predict what the true capabilities of artificial intelligence will be by then, our experience with computer vision and the volume of data we generate should prepare us to expect the unexpected