Derivation of Newton's Law of Gravitation

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November 29, 2023

Abstract

This paper is about newton's law of gravitation. It is a very important law in physics. It is given by the formula: $F = \frac{Gm_1m_2}{r^2}$. This law is very important because it explains why objects fall to the ground. It also explains why the moon orbits the earth. It also explains why the earth orbits the sun. It also explains why the planets orbit the sun. It also explains why the sun orbits the center of the galaxy. It also explains why the galaxy orbits the center of the universe. It also explains why the universe is expanding.

1 Introduction

Newton's law of gravitation is given by the formula:

$$F = \frac{Gm_1m_2}{r^2}$$

where:

$$\begin{aligned} F &\text{ is the gravitational force between two objects,} \\ G &\text{ is the gravitational constant,} \\ m_1 \text{ and } m_2 &\text{ are the masses of the two objects, and} \\ r &\text{ is the separation between the centers of the masses.} \end{aligned}$$

1.1 Derivation

The gravitational force is proportional to the product of the masses and inversely proportional to the square of the separation. We express this relationship as:

$$F \propto \frac{m_1 \cdot m_2}{r^2}$$

Introducing the gravitational constant G, we get:

$$F = G \cdot \frac{m_1 \cdot m_2}{r^2}$$

This is the formula for Newton's law of gravitation.

About LaTeX

What is LaTeX and How Does It Work?

LaTeX is a typesetting system widely used for the preparation of scientific and mathematical documents. It excels in handling complex equations and producing high-quality output. The system works by processing plain text files containing a mixture of formatting commands and regular text. Users create a LaTeX document by writing code that specifies the structure and formatting of the document. The LaTeX system then processes this code to produce a formatted document. The code is typically written in a plain text editor and saved with a `.tex` file extension.

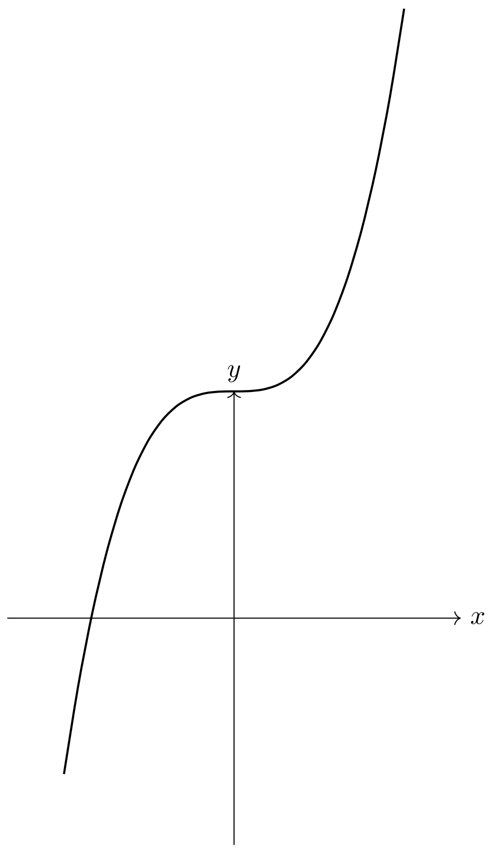

Figure 1: Graph of the function $y = 2xy^3 + x^3 + x^2y + 2$

Types of Neural Network Models

1. **Feedforward Neural Networks (FNN):**

   Basic neural network architecture where information travels in one direction, from the input layer to the output layer. Often used for simple classification tasks.

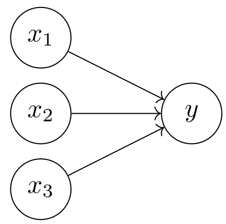

Figure 2: Feedforward Neural Network

2. **Multilayer Perceptrons (MLP):**

   An extension of feedforward neural networks with one or more hidden layers between the input and output layers. Widely used for various applications, including image recognition and natural language processing.

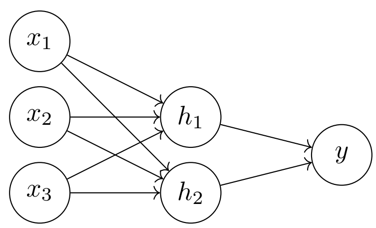

Figure 3: Multilayer Perceptron

3. **Convolutional Neural Networks (CNN):**

   Specifically designed for image recognition and processing. Uses convolutional layers to automatically and adaptively learn spatial hierarchies of features.

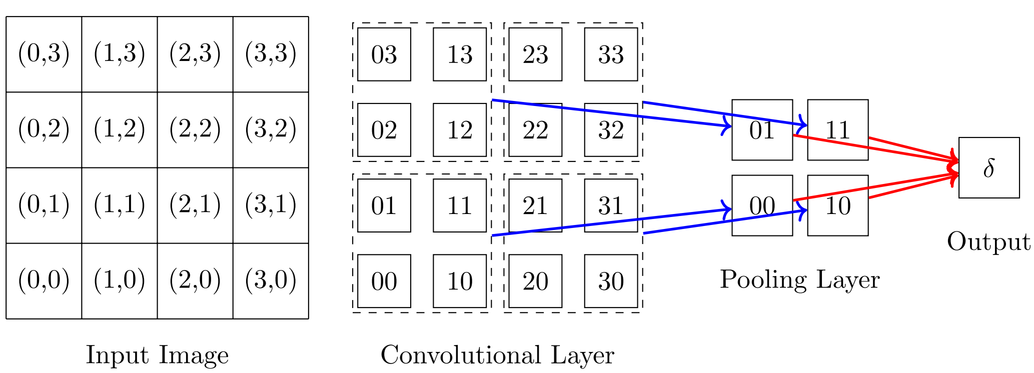

Figure 4: Convolutional Neural Network

4. **Recurrent Neural Networks (RNN):**

   Suitable for sequential data, such as time series or natural language. Has connections that form a directed cycle, allowing information persistence.

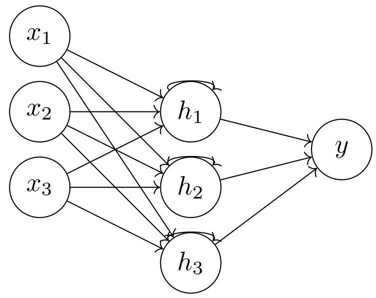

Figure 5: Recurrent Neural Network

5. **Long Short-Term Memory (LSTM):**

   A type of RNN with memory cells that can store information for long periods, preventing the vanishing gradient problem. Effective for learning and remembering over long sequences.

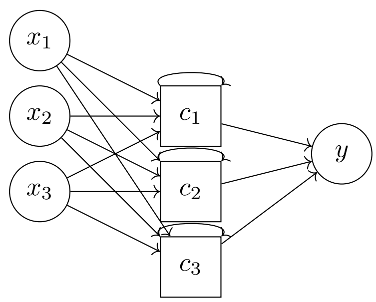

Figure 6: Long Short-Term Memory (LSTM)

6. **Gated Recurrent Unit (GRU):**

   Similar to LSTM but with a simpler architecture. Efficient in capturing dependencies in sequential data.

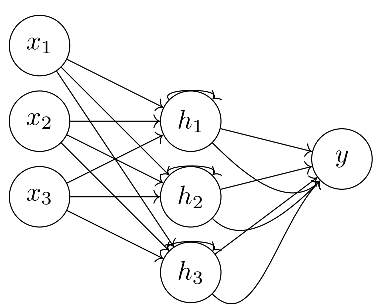

Figure 7: Gated Recurrent Unit (GRU)

7. **Autoencoders:**

   Unsupervised learning models that aim to learn efficient representations of input data. Consists of an encoder that maps input data to a lower-dimensional representation and a decoder that reconstructs the input from this representation.

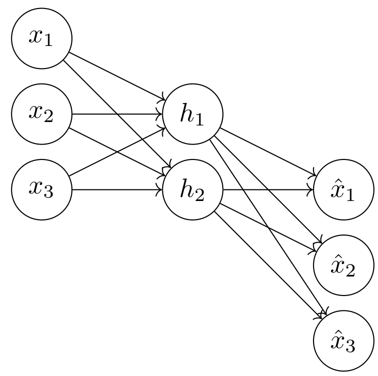

Figure 8: Autoencoders

8. **Generative Adversarial Networks (GAN):**

   Comprises a generator and a discriminator trained simultaneously through adversarial training. Used for generating new data that is similar to a given dataset.

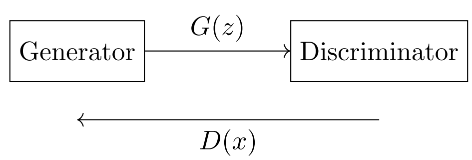

Figure 9: Generative Adversarial Networks (GAN)

9. **Radial Basis Function Networks (RBFN):**

   Utilizes radial basis functions as activation functions. Commonly used for function approximation and pattern recognition.

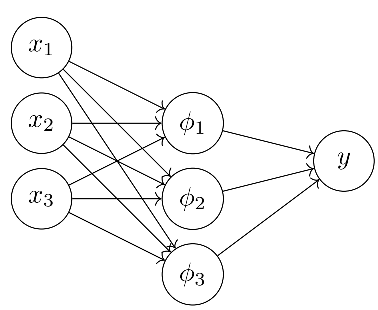

Figure 10: Radial Basis Function Networks (RBFN)

10. **Self-Organizing Maps (SOM):**

    Unsupervised learning models that map input data into a lower-dimensional grid while preserving the topological properties of the input space. Useful for clustering and visualization.

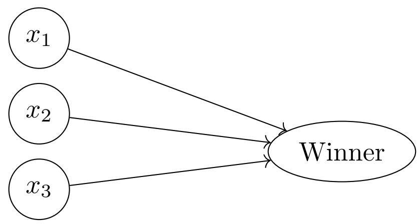

Figure 11: Self-Organizing Maps (SOM)

11. **Hopfield Networks:**

    A type of recurrent neural network used for associative memory and pattern recognition. Can store and recall patterns even if they are partially corrupted.

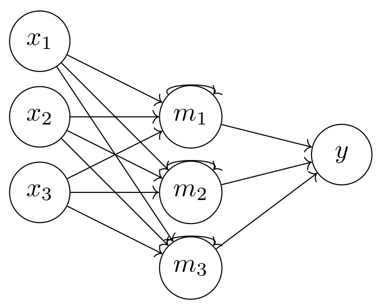

Figure 12: Hopfield Networks

12. **Neural Turing Machines (NTM):**

    Integrates the capabilities of a traditional Turing machine with a neural network. Enables learning and reasoning algorithmic tasks.

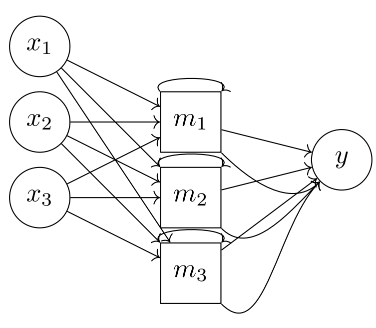

Figure 13: Neural Turing Machines (NTM)

13. **Transformers:**

Originally designed for natural language processing, especially for sequence-to-sequence tasks. Self-attention mechanism allows the model to weigh different parts of the input sequence differently.

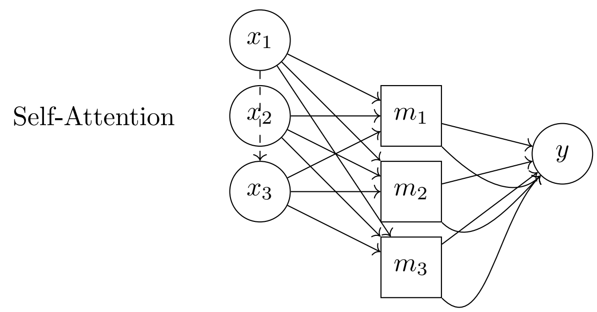

Figure 14: Transformers