IE643: Deep Learning : Theory and Practice **July-Dec 2021**

Lecture 2: Topic of lecture (30-July-2021)

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Disclaimer: *These notes have not been subjected to the usual scrutiny reserved for formal publications. They may be distributed outside this class only with the permission of the Instructor.*

2.1 Some topic

Discuss about the topics discussed in class in your own words. If you use text from some other source, cite them. Example of citation: Perceptron is described in [1, 2].

Write clearly about each topic discussed in class. Be complete. Be concise. Be comprehensive.

2.2 Example Section: Biological Motivation of Perceptron

The perceptron proposed by Rosenblatt [2] was motivated using a neuron present in human and other mammalian nervous systems. A human neuron contains a nucleus, an axon and dendrites (see Figure 2.1). The dendrites connect one neuron to other and help in the transmission of impulses between neurons. The nucleus processes the impulses and depending on biological considerations, the neuron either becomes activated and transmits the processed impulses to a subset of the adjoining neurons or remains inactive. A similar idea is used in perceptron. Perceptron accepts d inputs of the form $+1$ or -1 and then computes a weighted sum of the inputs using weights denoted by $w_1, w_2, \ldots, w_d$ and compares the weighted sum to a threshold θ and outputs either $+1$ or -1 indicating that the perceptron is active or inactive respectively. This is illustrated in Figure 2.2.

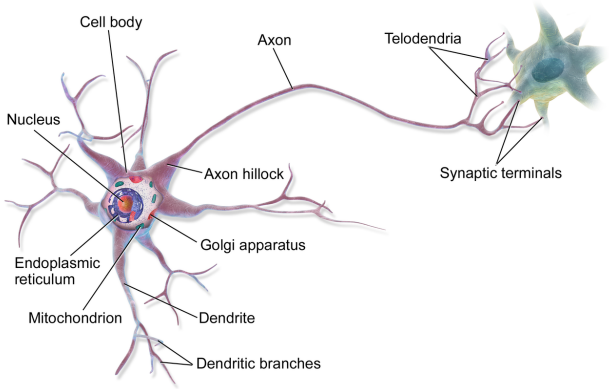

Figure 2.1: Structure of a neuron [3] (**Note:** cite source of the figure if it is not your own.)

2.2.1 Here's a subsection

Theorem 2.1. *This is how you can write a theorem.*

Proof. A sample proof of $|a+b| \leq |a| + |b|, \forall a, b \in \mathbb{R}$.

First note that

$$|a||b| \geq ab, \forall a, b \in \mathbb{R}. \tag{2.1}$$

This can be proved by considering the following four cases: (without loss of generality assume $a \neq 0, b \neq 0$)

- $a > 0, b > 0 : \implies |a| = a, |b| = b$. Hence $ab = |a||b|$.
- $a < 0, b < 0 : \implies |a| = -a, |b| = -b$. Hence $|a||b| = (-a)(-b) = ab$.
- $a < 0, b > 0 : \implies |a| = -a, |b| = b$. Hence $|a| \geq a$. Therefore, $|a||b| \geq ab$.
- $a > 0, b < 0 : \implies |a| = a, |b| = -b$. Hence $|b| \geq b$. Therefore, $|a||b| \geq ab$.

Also from the above arguments, note that

$$|a|^2 = a^2, \ \forall a \in \mathbb{R}. \tag{2.2}$$

Now consider $(|a| + |b|)^2$. We get

$$\begin{aligned}(|a| + |b|)^2 &= |a|^2 + |b|^2 + 2|a||b| \\ &= a^2 + b^2 + 2|a||b| \text{ (Using (2.2))} \\ &\geq a^2 + b^2 + 2ab \text{ (Using (2.1))} \\ &= (a+b)^2. \end{aligned} \tag{2.3}$$

Thus we have $(|a| + |b|)^2 \geq (a+b)^2$. Now taking square root on both sides, we get the required result $(|a| + |b|) \geq |a+b|$.

Hence the required proof. □

2.3 Template for algorithm

Write an algorithm using the following template.

Algorithm 1 A sample algorithm

Input: Here comes the input of the algorithm.
Initialize: Include any initialization.
for $k = 1, 2, \ldots$ **do**
    Here is the computation within the loop.
end for
if some condition **then**
    Do action 1
else
    Do action 2
end if
while some condition is true **do**
    Perform some computation
end while
Output: Write the output here.

Lemma 2.2. *This is how you can state any lemma*

Definition 2.3. *Example to write any definition*

Claim 2.4. *Claim can be stated like this.*

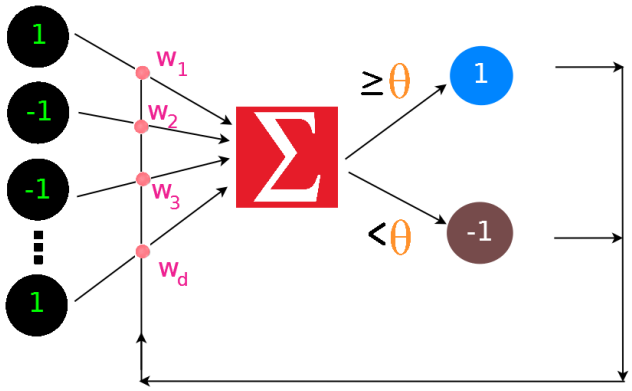

Figure 2.2: Example to add a figure

Once you've inserted the figure, you can refer to it as figure 2.2

2.4 Some general guidelines for scribing

1. Please note that slides will not be made available until scribes are ready. Only lecture video will be available. Please watch the video carefully and describe all the points discussed in the video.

2. Write all text yourself. Do not copy and paste text from some other resource. Copied material with a citation is also not allowed.

3. Prepare images yourself. You can use images in the lecture videos (you can use capture tools like vlc media player to take a screenshot of an image from video) but it would be great if you can prepare your own images and add to the scribes.

4. If you are forced to include some figure from some other resource, please include appropriate source (or website) from which the figure was taken. See e.g. Figure 2.1.
5. If there is something which you did not understand in the class, try to understand and be clear before writing. You can always discuss with the instructor or the TAs.
6. Try your best that these notes are useful to others.
7. Do not be informal in your notes!
8. Add the references in the bibtex file called demo.bib in this folder. Use them to cite the appropriate references. Examples of how to cite a paper are given in the sections above.
9. Do not miss any topic covered in class.

References

[1] Frank Rosenblatt. *The perceptron, a perceiving and recognizing automaton.* Cornell Aeronautical Laboratory, 1957.

[2] Frank Rosenblatt. The perceptron: A probabilistic model for information storage and organization in the brain. *Psychological Review*, pages 65–386, 1958.

[3] Wikipedia contributors. Neuron — Wikipedia, the free encyclopedia. `https://en.wikipedia.org/w/index.php?title=Neuron&oldid=973943839`, 2020. [Online; accessed 20-August-2020].