SNS COLLEGE OF TECHNOLOGY

Coimbatore-37.
An Autonomous Institution

COURSE NAME : 19CST301 & INTRODUCTION TO MACHINE LEARNING

III YEAR/ V SEMESTER

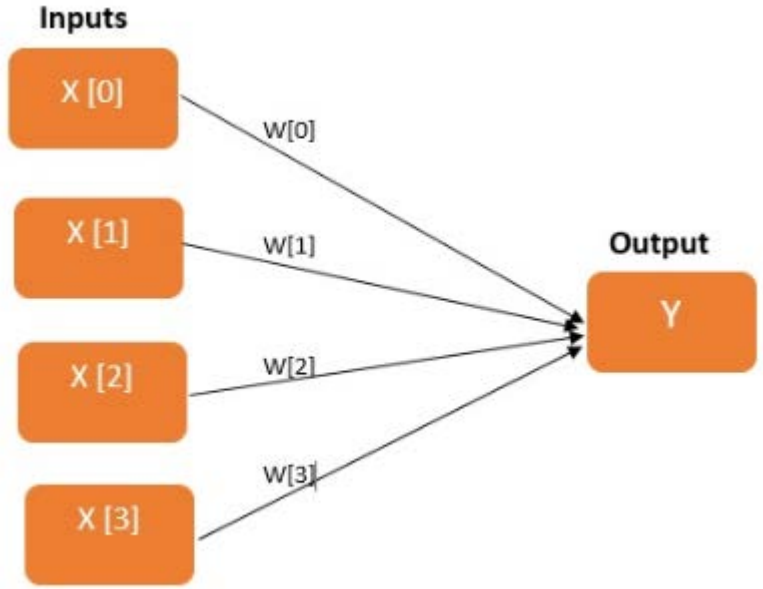
UNIT – 3 DEEP LEARNING

Topic: Bayesian Neural Net

Mrs.S.R.Janani
Assistant Professor
Department of Computer Science and Engineering

Bayesian Neural Net

- Bayesian Neural Networks (BNNs) refers to extending standard networks with posterior inference in order to control over-fitting.
- From a broader perspective, the Bayesian approach uses the statistical methodology so that everything has a probability distribution attached to it, including model parameters (weights and biases in neural networks).



- In programming languages, variables that can take a specific value will turn the same result every-time you access that specific variable.
- Let’s begin with the revision of a simple linear model, which will predict the output by the weighted sum of a series of input features.
- In comparison, in the Bayesian world, you can have similar entities also known as random variables that will give you a different value every time you access it.
- In Bayesian terms, the historical data represents our prior knowledge of the overall behavior with each variable having its own statistical properties which vary with time.

- Let’s assume that X is a random variable which represents the normal distribution, every time X gets accessed, the returned result will have different values .
- This process of getting a new value from a random variable is called **sampling.**
- What value comes out depends on the random variable’s associated probability distribution.
- That means, in the parameter space, one can deduce the nature and shape of the neural network's learned parameters.
- Recently there has been a lot of activity in this area, with the advent of numerous probabilistic programming libraries such as PyMC3, Edward, Stan etc.
- Bayesian methods are used in lots of fields: from game development to drug discovery.

Advantages of BNNs

- Bayesian neural nets are useful for solving problems in domains where data is scarce, as a way to prevent overfitting.
- Example applications are molecular biology and medical diagnosis
- Bayesian nets are universally useful
- They can obtain better results for a vast number of tasks however they are extremely difficult to **scale to large problems.**
- BNNs allow you to **automatically calculate an error associated** with your predictions when dealing with data of unknown targets.
- allow you to estimate uncertainty in predictions, which is a great feature for fields like medicine

Why should you use Bayesian Neural Networks?

- Instead of taking into account a single answer to one question, Bayesian methods allow you to consider an entire distribution of answers.
- With this approach, you can naturally address issues such as: regularization (overfitting or not),
- model selection/comparison,without the need for a separate cross-validation data set

References

- AlpaydinEthem, “Introduction to Machine Learning”, MIT Press, Second Edition, 2010.
- Trevor Hastie, Robert Tibshirani, Jerome Friedman, “The Elements of Statistical Learning: Data Mining, Inference, and Prediction”, Springer; Second Edition, 2009.
- https://www.databricks.com/glossary/bayesian-neural-network


Thank
you