

a. What is a neural network and how does it work?

Neural network is a computational model inspired by neurons in the human brain. It consists of neurons, and connections. Each neurons are connected together and compute any function. Thus, it is also known as universal function approximator.

b. Explain the concept of backpropagation in deep learning.

Deep neural network uses backpropagation to train or learn its weights with a loss function. Backpropagation is an important process where it uses chain rule of the loss function to train the deep neural network. Since deep neural network has many hidden layers. Thus, the loss function will perform the chain-rule up till the input layer to learn the function to approximate output better.

c. What is the purpose of the activation functions in neural networks?

The purpose of activation functions is to introduce non linearity in the deep neural networks. Neural networks is just a linear combination of neurons. Even if there is cascaded linear combinations of hidden layers in deep neural network, it is still a linear model. Thus, adding activation function for the output of the hidden layer or output layer will introduce non-linearity that allows it to learn complex functions from the data.

d. How can you prevent overfitting in deep learning models?

To prevent overfitting in deep neural network, regularization methods such as L1, L2 regularization, dropout, can be used to prevent overfitting in the neural networks. Besides, data augmentation methods can help the model to generalize better. Moreover, early stopping mechanism can helps to stop training and prevent overfitting.

e. What are convolutional neural networks (CNNs) and when are commonly used?

Convolutional neural networks are class of deep neural networks where it uses the concept of convolution, which involve the sliding a filter across the input data. This allows the network to capture local patterns and features. It is commonly used in computer vision application where it can capture spatial data (2-d or more). The applications in computer visions such as image classification, object detection, image segmentation and more uses convolutional neural network to build state-of-the-art model.

Section 2

a. What is the difference between HTML, CSS, and JavaScript?

Html (hypertext markup language) – is a markup language to structure and present content on the website. It defines the basic structure of a webpage like headings, links, subheadings.

Css (cascading style sheets) – is a style sheet language and used to control the presentation content of the HTML documents. It defines the colors, fonts, spacing in the HTML.

Javascript – is a type of programming language that enables interactivity and dynamic behavior on the web pages. It allows developers to create responsive interactive elements such as handle user input, modify the content dynamically without reloading the page, and interact with web Apis.

In summary, HTML provides the structure of a webpage, CSS controls its presentation and layout, and JavaScript adds interactivity and dynamic behavior.

b. Explain the box model in CSS.

The css box model is a fundamental concept that describes how elements on web page are rendered based on the four main components which are content, padding, border, and margin. Margin will be the space outside outer box, border will be inner space of margin, padding will be inner space of padding, and lastly content is wrapped around by these components. Each components dimensions can be modified accordingly.

c. How can you optimize website performance in terms of load time?

I will optimize image size and format which can take up a lot of bandwidth which affects the loading time of the page.

Secondly, reduce number of elements on page such as image, scripts and stylesheets will reduce the HTTP requests. Thus, fewer request will lead to faster loading times.

Thirdly, I will optimize caching where repeated page loads can be loading from cache rather than download from the network again.

d. What are the benefits of using a CSS preprocessor, such as Sass or Less?

Using preprocessors can help you improve your productivity and code quality. Preprocessors allow the use of variables to store and reuse values throughout the stylesheet. This makes it easier to maintain consistency and quickly update values across the entire project.

Sass stands for Syntactically Awesome Style Sheets which uses indentation instead of brackets and semicolons.

Less stands for Leaner Style Sheets has a syntax that is close to CSS but with some added features such as variables, mixins, and functions.

e. How would you make a responsive website design?

To make a responsive website design, I will be designing website using flexible grid layouts, next mobile first design, where design for smaller screens then gradually for larger screens. Besides. I will use CSS flexbox and grid for creating flexible and responsive web page structures.

Section 3

a. What is the difference between a virtual server and a physical server?

Physical server is a bare-metal server where it is a tangible, standalone piece of hardware with its own dedicated resources such as cpu, ram, etc.

Virtual server is VM (virtual machine), is a software based simulation of a physical server. It can run multiple virtual server on a physical server sharing its resources. Each Vms can be act or operates independently, isolated from others.

b. Explain the concept of load balancing and its importance in server infrastructure.

Load balancing is a technique used to distribute incoming network traffic across multiple server. If there are multiple requests incoming, load balancing needs to bears overwhelming amount of the load, preventing performance degradation or bottleneck of a single server. It distribute the loads and tasks to other servers. If there is no load balancing, the server will breakdown when there is huge amount of traffic flowing.

c. How does caching work and how can it improve website performance?

Caching is a technique to store and reuse previously fetched computed data, reducing the need to repeatedly generate or fetch same information. Storing copies of frequently access data, caching can significantly improve website performance by reducing latency. It can store copies of resources like image, stylesheets or scripts locally on a user's device. Thus, this greatly improve faster loading times since it reduce the time to fetch resource from server.

d. What are the key considerations when choosing a database for a web application?

Determine the data models, there will be 2 different types of data model which are structured data and unstructured data. If the data is structured, choosing a relational database such as MySQL will be suitable for web application. If there is a need to store unstructured data, Mongoddb and other non-relationship databases will be better for the application. Unstructured databases are schema-less and flexible schema and able to scale large volumes of unstructured data.

Besides, cost consideration is also another key consideration of choosing database since there are operational cost for the databases. Different databases have different cost.

Lastly, performance requirements is a type of key consideration when choosing database. Need to know the ratio of read to write operations in your application. Some databases can read heavy workloads fast while some databases can write heavy workload fast.

e. Explain the difference between horizontal and vertical scaling.

Horizontal scaling is also known as scaling out where it involves adding more machines or nodes to a system to distribute the load.

Vertical scaling is a type of scaling where it involves increasing the capacity of the machine by adding more resources.

Resource allocation:

horizontal scaling - Involves adding more machines to distribute the workload.

Vertical scaling - Involves upgrading the capacity of a single machine.