



Wall For All

Department of Computer Applications
Chitkara University Institute of Engineering & Technology
Chitkara University, Punjab

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Dear Readers,

The nostalgic feeling that one experiences while sifting through the dusty old pages of the college magazine cannot be expressed in words. However, very few of us have retained those copies, and most of those precious articles that we wrote during those golden days with enthusiasm are lost forever. With the advent of e-books and other online media, the days of paper-bound college magazines are gone, and the digital platform has paved way to allow retention of such publications without much effort.

Wall-for-All, the e-Magazine published by the Department of Computer Applications, is one such effort that was started with an intent to provide a chance to all students and faculty members to share their thoughts and knowledge, and hone their skills in creative writing.

I am happy to see the enthusiasm of eminent members of the department to contribute to *Wall for All*. This shows the positive and creative energy of the contributors. However, it would be really wonderful if we can see the articles contributed by more students in the next editions, for this e-Magazine is intended to be a writing pad for each member of the department.

I proudly present the current edition of *Wall for All*.

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Fundamentals of Cyber Physical Systems

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The Cyber physical system (CPS) has transformed the way of interaction with the physical world. It is all about to design computational algorithms to control the physical entities. It is the interaction of digital, analog, physical and human components engineered to function through logic. The main features of CPS are the firm coordination and combination between the systems' physical and computational elements. Physical entities are connected to the cyber world through the wireless network. Off-the-shelf cyberspace, the computational algorithms to control and / or report the actuation information of the physical entities, are the basic traits of CPS, as shown in Figure 1 [1].

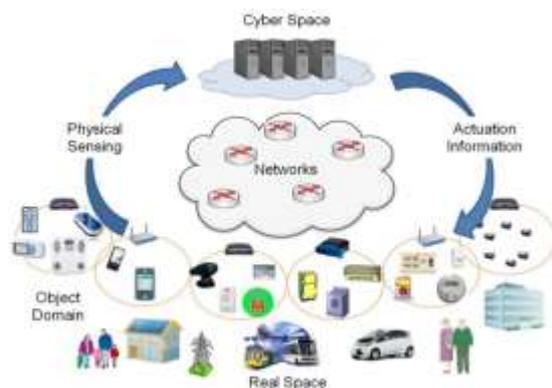


Figure 1: Cyber Physical System

Properties of CPS

Typically, a CPS has four basic properties: i) Sense, ii) communicate, iii) compute and iv) control. For the working of system, all properties complement each other, as illustrated in Figure 2. The computations and communication are deeply embedded in CPS and make itenable to interact with physical processes to add new capabilities to the physical system [2]. The properties of CPS entities or components do not change even if these are interacting with each other, but their behavior can change. The change of behavior depends upon the designed computational and control algorithms. CPS systems are heterogeneous in components and design requirements and their architecture vary application to application. The general architecture is given in the next section.

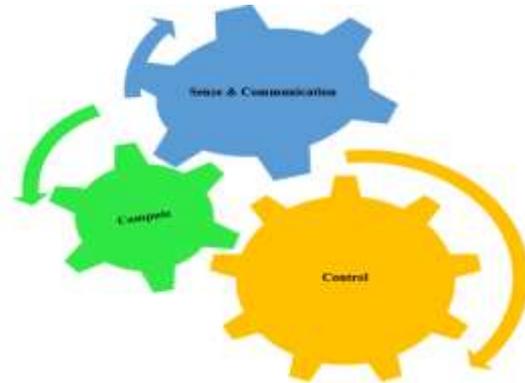


Figure 2: Properties of CPS

General Architecture of CPS

CPS is basically enabling to interact and control the physical instances using sensors and actuators [3]. CPS implementation can be divided into four stages, as shown in Figure 3.

- i) **Sensing:** Sensing is the first stage of the CP system and physical interaction of entities takes place at this stage. It consists of the physiological or non-physiological sensor. The type of sensor depends upon the application type. Sensors can sense the environment or living or nonliving objects and so on. For example: In health applications, physiological sensors like ECG, EEG, pulse, respiration, accelerometer and so on sensors are used. In home automation, motion sensors, IR, ultrasonic or laser sensors can be used.
- ii) **Communication Channel:** Communication channels, communicate the sensed data over the local data center or global server (cloud). Most of the time, wireless sensors are used to communicate the data. Logical connections are created for sensed data communication. The developer can choose any wireless communication mode to send, such as Bluetooth, Zigbee or WiFi. WiF is used to send the data on cloud whereas Bluetooth or Zigbee are chosen for the local server, it depends on the type applications.
- iii) **Data aggregator and Computation:** At this stage, the data is preprocessed and make it enable to compute. Preprocessing can involve data filtration, segmentation and or classification. After computations e-utilities are generated and forwarded to the next stage.
- iv) **Decision and Actuator:** This is the last stage of the CP system. Here the logical algorithms reside, which help to control the actuators or the output peripherals

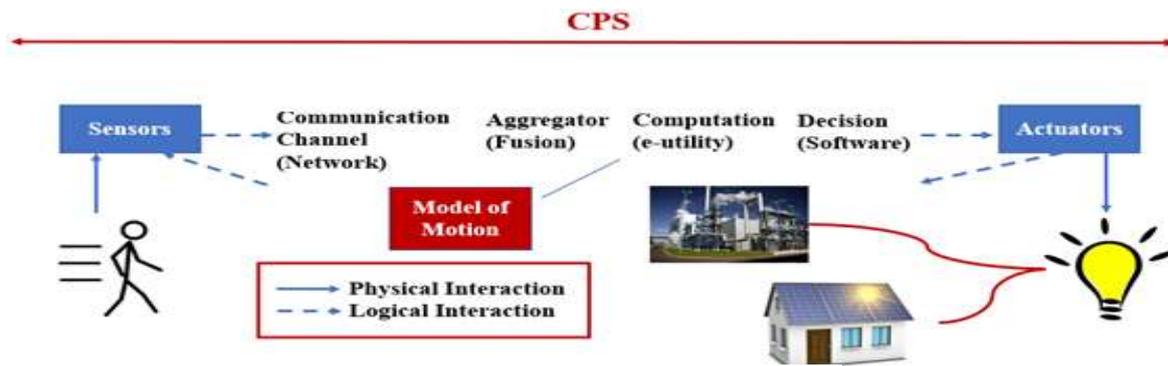


Figure 3: Architecture of CPS

For example, in home automation, a room lamp on-off is controlled by the human entry in the room, the scenario shown in Figure 3.

Benefits and Opportunities Created by CPS

Large numbers of microcontroller boards are available in the electronics market. These microcontrollers are tiny in size and these mini packages are a complete pack of mini computers. These embedded computers allow us to add capabilities to physical systems. It is safer and more efficient to design CP systems by using the embedded microcontroller boards [3], [4]. The benefits of CPS are listed below: CPS reduce the cost of building and operating the systems.

- Complex systems can be formed to provide new capabilities
- The decreasing cost of computation, networking, and sensing provides economic motivation.
- Computers and communication are ubiquitous enable national or global scale CPSs. (eg. national power grid, national transportation network)
- CPS has created lots of opportunities in the listed application areas:
 - Automated chemical industry
 - Transportation
 - Defense
 - Healthcare
 - Civil infrastructure
 - Energy
 - Manufacturing
 - Entertainment
 - Robotics

Open Issues and Future Scope

Presently many researchers are designing the CPS models for multiple application areas, as mentioned in the previous section. They are focusing on the CPS areas like a standard architecture, Quality of Service (QoS) enabled communication protocols, power management, interoperability in CPS entities and many more. A generic software architecture required to analyze the behavior of CP systems. Low cost, energy-efficient and reliable end-

to-end networking protocols need more attention from future researchers. QoS aware, power management, resource management and communication protocols are still the open issues in CPS [3], [5].

Conclusion

This article provides a brief fundamental overview of the Cyber Physical System. Here we discuss the basic properties of CPS such as sensing, communication, computing and controlling the physical devices. The general architecture of CPS represents the way of remotely interacting and controlling the physical entities. CPS has created opportunities in many application areas like home automation, vehicular networks, and healthcare and so on. QoS aware implementation is still an open issue in CPS and future research can be continued on the security of CP systems.

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Brief Review of Deep Learning

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The use of deep learning is ubiquitous in every domain of science. It is mostly used in the analysis of complex data. The concept of deep learning is generally divided into three categories-Deep Autoencoders, Convolutional Neural Networks and Long Short-Term Memory Networks. This article presents a brief review of these deep learning techniques.

Introduction

In 1943, McCulloch and Pitts [1] presented the first neuron model. It is a simple mathematical model which simulated the working of a biological neuron. This model is binary in nature. It inputs and outputs binary values. The model is divided into two parts. The first part I takes an input perform calculation and pass it to the second part O which takes binary decision based on the input as shown in the Figure 1. It is first model of the perceptron.

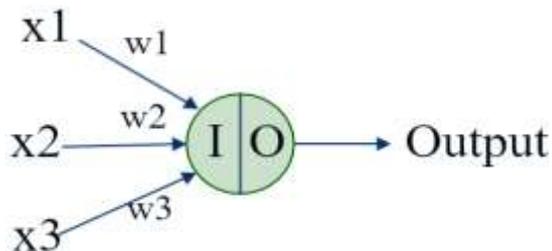


Figure 1: McCulloch and Pitts Model of Neuron

But it did not represent the actual working of the neuron as defined by Frank Rosenblatt [2]. He presented the first modern neural network as he envisioned learning process of the perceptron. He used the phrase “back-propagating error correction” which is very common now a days in machine learning community. Rosenblatt theory

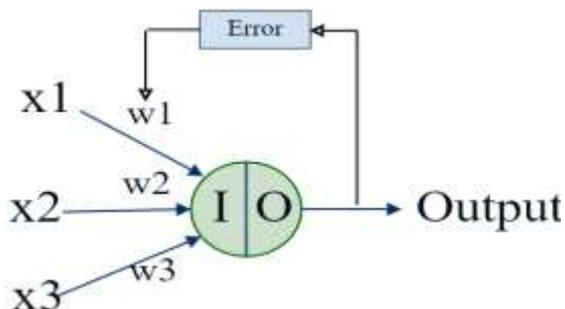


Figure 2: Schematic of Rosenblatt's Perceptron

is based on Hebbian theory which explains the working of brain during learning process in humans. His model presented the element of learning by back propagating the error between the predicted and actual output.

This made the very foundation of deep learning. Afterward, in 1986, the term Deep learning was first used by Rina Dechter explaining the model of neurons. Afterwards, Alexey Icahenko and Lapa presented the first functioning deep learning model in 1965 as shown in Figure 2. This model incorporated multiple layers perceptron with the help of statistical methods. The deep learning has more learning layers as compared to traditional machine learning models. Afterwards, Ivakhnenko made 8-layer deep network in 1971 called Alpha. Afterwards, with the advent of ImageNet, Alexnet and LSTMs it progressed into today's modern deep learning. Deep learning is generally divided into three categories--Deep Autoencoders (DAE), Convolutional Neural Networks (CNN) and Long Short-Term Memory Networks (LSTM).

Deep Autoencoders (DAEs)

Autoencoders are 3-layered neural network which are mostly used for dimensionality reduction. These are unsupervised in nature. It can be used to compress the image and data. It outperforms the most popular dimensionality reduction algorithm, Principal Component Analysis (PCA). It can also mimic the functionality of PCA if the linear sigmoid function is used. It is also used for denoising, machine translation, etc. Its main task is to efficiently represent high dimensional data in lower dimensional space as shown in Figure 3. It transforms the input in two steps:

1. In the first step, the original dimensions are mapped to hidden layer which can be represented as:

$$HD^L = W_1 \times IP^O + b_1$$

Where HD is the hidden layer, L is the dimension of hidden layer, W is the weight associated, IP is the input and b is the bias and $L < O$.

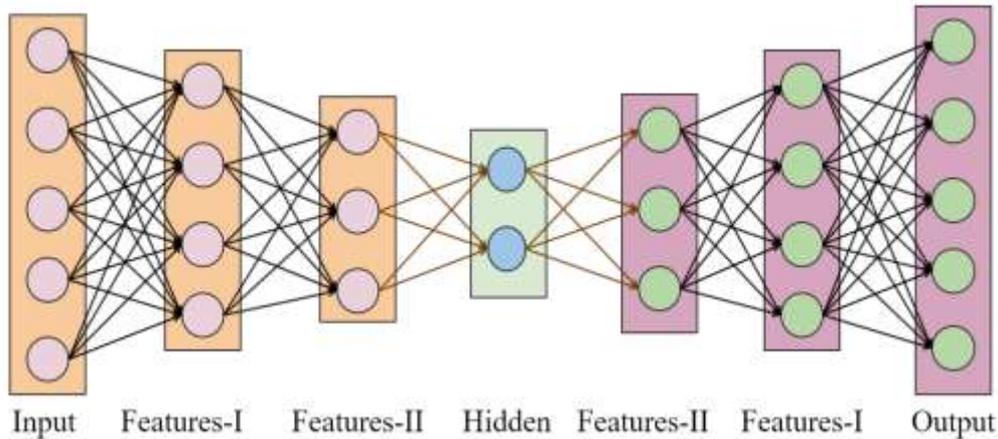


Figure 3: Deep Autoencoders

- In the second step, the reconstruction is performed from the features obtained from hidden layer:

$$\widehat{IP} = W_2 \times HD^L + b_2$$

In the end, \widehat{IP} is matched against IP. If both are approximately equal then weights are considered to be optimal. If the error is big, it is backpropagated through gradient descent to reduce it. This can be defined as:

$$OP(IP, \widehat{IP}) = ||\widehat{IP} - IP||^2$$

Where OP is the output and the difference between \widehat{IP} and IP is considered as the distance loss.

Recurrent Neural Network

Recurrent Neural Network (RNNs) is a category of neural network which generates superior performance when input sequential in nature. These networks can remember short-term and long-term dependencies. But in practice, these do not perform well due to the problem of vanishing gradient.

Long Short-Term Memory Networks

The problem of vanishing gradient is solved by Long Short-Term Memory Networks [3] as shown in Figure 4. The presence of the forget gate enables it to selectively remember important part of the sequence. By doing this, it can easily remember short-term as well as long-term dependencies of the input data. It is mostly used for sequential problems like time-series, speech analysis, weather forecasting etc. The transitions functions are defined as follows:

Input gates: $n_t = \sigma(W_n \cdot [O_{it-1}, x_{it}] + b_n)$

Forget gates: $G_t = \sigma(W_G \cdot [O_{it-1}, x_{it}] + b_G)$

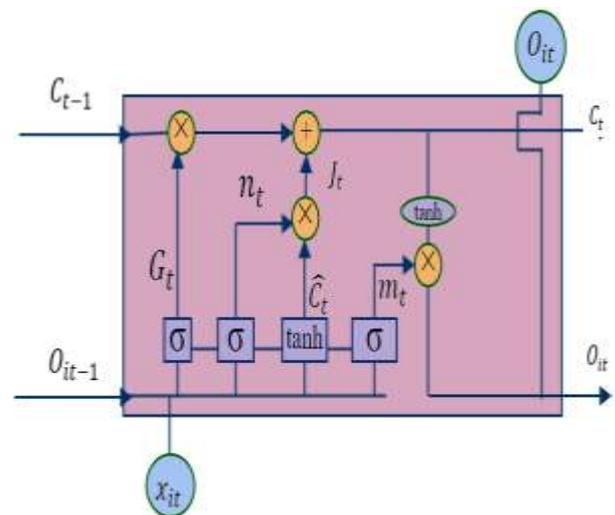


Figure 4: Long Short -Term Memory Networks

New Candidates:

$$\hat{C}_t = \tanh(W_C [O_{it-1}, x_{it}] + b_C)$$

Cell States: $C_t = G_t \circ C_{t-1} + n_t \circ \hat{C}_t$

Output gate:

$$m_t = \sigma(W_{OP} [O_{it-1}, x_{it}] + b_{OP})$$

Next hidden state:

$$O_{it} = m_t \times \tanh(C_t)$$

Where σ is the sigmoid function, \tanh is the tangent hyperbolic function, W is the weight, OP is the output, \circ is the Hadamard product, b is the bias, t is the present time state.

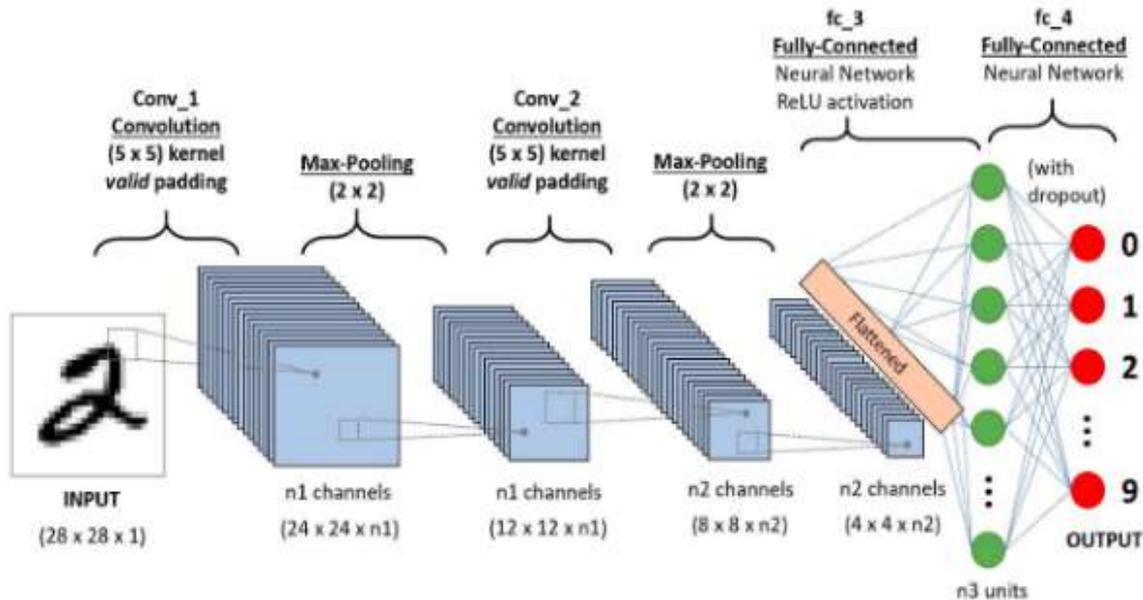


Figure 5: Convolutional Neural Network

Convolutional Neural Networks

Convolutional Neural Networks (CNNs) as shown in Figure 5 is a category of neural network which forms meaningful connections when image data is input. CNN can form meaningful connections by understanding spatial and temporal features of the images. It is mostly used for classification and regression problems. The Convolutional operator is performed by placing the filter on an image.

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Web Usage Mining

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Web usage mining is used to discover interesting user navigation patterns and can be applied to many real-world problems, such as improving Web sites/pages, making additional topic or product recommendations, user/customer behavior studies, etc. A Web usage mining system performs five major tasks: i) data gathering, ii) data preparation, iii) navigation pattern discovery, iv) pattern analysis and visualization, and v) pattern applications. Web usage mining is the branch of Web mining which is used for summarizing meaningful user access patterns' data from server log files. Log files are stored on the server and they keep records of data of every user who visits the web pages. New patterns of data can be discovered for E-commerce websites, and product-oriented and events on websites. In Web usage mining data is processed from Web server log files, where access permission and privacy of data are major issues. Web usage mining can be categorized into mainly three phases of processing.

- Pre-Processing
- Pattern Discovery
- Pattern Analysis

Pre-Processing

Preprocessing is first step in web usage mining where data is pre-processed by applying techniques such as integration, cleaning the data, filtering the data and transforming the data, in such a manner that users eliminate irrelevant data from log files. Preprocessing is a time-consuming step due to the vast variety of server log files. That is why, web usage mining takes more time to process when compared with other web mining techniques. In this phase of preprocessing, data cleaned via user identification and session identification. A session is described as group of activities performed by a user when user navigating through a given website. It is a complex task to identify the session from the raw data, because web server logs files not always contained all the information required. Web server logs files do not contained desired information for reconstructing user sessions. for example, time-oriented heuristics can be used after analyzing the sessions.[4]

Pattern Discovery

This is the second phase of web usage mining following Preprocessing of web server log data. Pattern discovery act as most useful and important process in web usage mining through which we mined the usefulness of the data. This process is most important techniques under association rule. Data mining methods are more reliable and efficient for the discovery of hidden patterns [6]. But today mostly research is in the direction of supervised methods while unsupervised methods are not being applied for pattern extraction from server log files.

Pattern Analysis

Pattern Analysis used in web usage mining where data is processed to give information and visualization of interesting patterns found in the user web log data, are performed. In this step of Web Usage mining the insignificant rules are removed, data is represented and then OLAP tools are applied. Pattern discovery and analysis are major processing phases of web usage mining. [6]

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Call for Articles

At Chitkara University, the endeavor has always been to hone the skills of learners. Keeping in line with this tradition, the Department of Computer Applications, Chitkara University, Punjab had come up with an online magazine titled **Wall for All**. This magazine was proposed to provide a platform to the budding learners to share their knowledge and general information pertaining to the computing field. **Wall for All** is available for free download in PDF format from CA departmental website: **ca.chitkara.edu.in**.

The students and faculty members are invited to be a part of this venture and contribute their articles to the magazine. The students may forward the articles through their respective mentors while faculty members may send the same directly to the editors of **Wall for All**.

Future of Mobile Development – React Native?

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When we think about future of Mobile Development, we get to listen about React Native. So, before Discussing about it we should know what React Native is all about.

What is React Native?

React Native is a structure that constructs a chain of command of UI segments to assemble the JavaScript code. It has a lot of parts for the two iOS and Android stages to assemble a versatile application with local look and feel.



Source: Google Images

ReactJS, on the other hand, is an open source JavaScript library to create user interfaces. However, both React Native and ReactJS are developed by Facebook using the same design principles, except designing interfaces.

Why React Native?

- **Open Source**

React Native has a very large community of programmers working constantly towards bug fixing, feature improvement and helping people to use it at ease.

- **UI-Focused**

React Native is totally centered on UI. Respond Native applications sport a profoundly responsive interface. React Native and the Native condition of the gadget lessens burden times and gives a smoother feel of your application.

- **Incorporate the Functionality of the Third Party Apps**

React Native is perfect with outsider modules. To include Google Maps' usefulness into your application, just

download an outsider module and afterward interface it to a local module. Additionally your application utilize the gadget's capacities like pivot, zoom and the compass, with no issue.

Is React Native Better than Native?



Source: Google Images

React Native has its focal points when the application should work for the two stages or when you have a tight time spending plan. It is additionally a decent decision when the engineers have involvement in web improvement or when making a basic application with no perplexing usefulness.

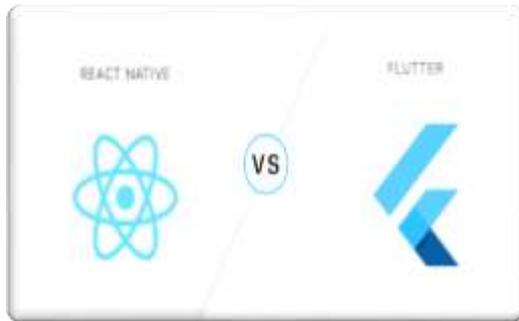
React is the preferred decision in most different cases. Having knowledge in the React language and the native APIs is required when creating in React Native as well. This means that if you are a beginner it is strongly recommended to start by developing a native application.

React Native vs Flutter & Dart

It is an interesting time in mobile development. We are moving away from just native development for iOS or Android and embracing newer technologies that build cross-platform mobile apps.

I do not question the capabilities of Flutter because it helps in creating beautiful mobile apps and helps start-ups to start earning in no time. Flutter has a long way to go and it has an impressive future.

Hence, it is very difficult to determine which the winner is as both have their own pros and cons. But I can say that since Flutter is a new framework, it will take some more



Source: Google Images

time to get stable in the industry compared to React Native.

Future of React Native

React Native is undoubtedly the future of mobile app development as it can build even the most complex apps seamlessly. It is **lightweight, fast, cost-effective and fun to code** and these are just a few of the many reasons why it is the go-to framework for developers across the globe. Therefore, if you plan to build a successful app, investing in a React Native technology is worth everything.



Source: Google Images

Conclusion

Despite having few loopholes and hiccups, the REACT Native Framework passes all the tests and hurdles to become the number one choice for almost every React Native Development Company to develop the mobile apps. A React native developer not only finds the agility and ease while developing the apps, but also experiences the high efficiency and low cost workload during the process. What makes the process more exciting is that you do not need to focus on both iOS and Android platforms to create the app.

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The Age of Thinning Machines!

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AI is probably the most important thing the humanity has ever worked on. I think of it as something more profound than maybe electricity or fire. We harnessed fire for benefiting humanity but we had to minimise the downsides too. So while AI is really important, we have to be concerned as well!

Sundar Pichai, CEO, Google

Who better than Google CEO to explain how important artificial intelligence (AI) is and how dangerous too.

Google is used billions of times in a day, by billions of people around the world. It can translate your search in many languages, throwing up hundreds of matching results. All thanks to AI.



Source: www.scientificamerican.com

That's not all. You enter your home and get greeted by Siri or Alexa. The music of your choice turns on and so does your air conditioner. You switch on the television and Netflix shows you recommendations for programmes you might like. Your email gives you a list of spam mails. You step outside and spot a drone in a busy market taking pictures to ensure safety for Republic Day celebrations. Welcome to the age of artificial intelligence (AI) or should we say thinking machines! But can machines think and act as humans? Computer science would like to believe, they can and will.

What is AI?



Source: www.surveyto.com

- AI, simply put, is building programmes that can mimic human intelligence. In their groundbreaking textbook *Artificial Intelligence: A Modern Approach*, authors Stuart Russell and Peter Norvig define AI as not only thinking and acting humanly but also thinking and acting rationally.
- But one of the biggest misconceptions about AI is that there is a super intelligent being that knows all and can do all better than all of us together. That's so not true. AI is built on us and is mimicking our thought process.

How does AI work?



Source: www.twitter.com

AI aims at building smart machines capable of doing things that require human intelligence. The computer has to learn how to react to specific actions do it uses algorithms and historical data to create model for tendency to behave in a particular way.

Strong AI and Weak AI

AGI also called "strong AI" is the kind of artificial intelligence we see in the movies, like the robots from Westworld or Star Trek: The Next Generation. It's a machine with general intelligence much like a human being and it can apply that intelligence to solve any problem on its own just like humans do.

With weak AI, the machines cannot do this on their own and rely on human interference.

No more Smart Phones for Next Decade

Smarter AI would also mean smartphones will become obsolete, replaced by an age of wearable communication devices that will change the manner by which we communicate with the world.

Next Generation Intelligent Assistants

The next generation intelligent assistants like Siri and Alexa will also be more intelligent. We also won't have to input as much information as we once did. Imagine a vastly better version of Siri or Cortana that will learn to figure out what we want or do sometimes before we realise it ourselves!

But as forewarned by Pachai, we need to be watchful of the downsides. **Tesla boss Elon Musk** has dubbed artificial intelligence as a bigger threat than North Korea and predicts a global race to develop artificial intelligence will result in World War 3.

Not all fears are unfounded. The foremost being joblessness. Machines will pretty much perform what humans can while humans may not be able to outperform machines.

Also, as seen with smartphones and other technology already, humans can become too dependent on AI and lose their mental capabilities. Machines can be the most lethal weapon if they fall in the wrong hands. Not to forget that as robots, AI can replace humans, enslaving us.

But **Facebook CEO Mark Zuckerberg** does not share the cynicism around AI. He is optimistic about what artificial intelligence can do now and will be able to do in the future.

Whichever side of the debate you choose to be, none can disagree with **Jack Uldrich**, a futurist author, when he says, "**The transition we are about to experience is we're**

going to go from accessing the internet to living in the internet."

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EDITORIAL SECTION

At Chitkara University, the endeavour has always been to hone the skills of the learners. Keeping in line with this tradition, the Department of Computer Applications, Chitkara University, Punjab, has come up with an online magazine titled Wall for All. This e-magazine is proposed to provide a platform to the budding learners where they can share their knowledge and also the general information pertaining to the computing field. This e-magazine also provides an opportunity to the faculty members to share their ideas and views on topics of general interest. Wall for All is available for free download in PDF format from departmental website ca.chitkara.edu.in.

We hope to get due feedback from our readers which can help us in improving our further issues.

“HAPPY READING”

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