ELECTRONICS & COMMUNICATION ENGINEERING

TECH CONNECT

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Contents

1. ADABOOST

INTRODUCTION:

AdaBoost, is also known as "Adaptive Boosting", is a machine learning algorithm used with several types of learning algorithms to improve their performance. It can be used for both classification and regression problems.

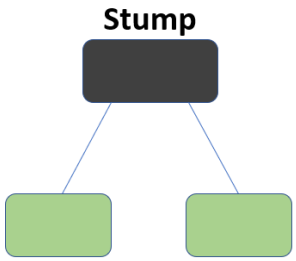
Adaboost helps you combine multiple “weak classifiers” into a single “strong classifier”. The weak learners in AdaBoost are decision trees with a single split, called decision stumps. AdaBoost works by putting more weight on difficult to classify instances and less on those already handled well. Then all the points which have higher weights are given more importance in the next model. It will keep training models until and unless a low error is received.

WORKING:

Step1: Consider a dataset which contains some attributes and samples. Initially same sample weight is created for all the records which is given as W=1/n, where n is number of samples.

After creating the first stump, the sample weight will change in order to guide how the next stump is created.

Step2: In this step, base learners will be created with the help of decision trees. Stumps will be created for all the attributes.



Step3: Now we will calculate entropy for all the stumps. The tree with the lowest entropy will be our first stump.

Step4: Calculate total error for the first stump. Total error for a stump is the sum of the weights associated with the incorrecly classified samples. Total error will be 0 for a perfect stump and 1 for a misclassified stump.

Step5: calculate the performance of stump by using the formula

Performance of stump = 1/2 log(1-total error/total error)

We have to update the sample weights with the help of performance of stump. The weight of correctly classified sample will be decreased and the weight of incorrectly classified stump will be increased.

New weight = Weight * e(performance)→for incorrectly classified samples

New weight = Weight * e-(performance)→correctly classified samples

Step6: Divide each updated weight with sum of all updated weights. Then we will get the normalized weights. Now a new dataset will be created by randomly picking a number between 0 and 1.Since incorrectly classified samples have higher weights, the probability to select those samples is very high. The sample which lies in the range of the selected number will be kept in the new dataset.

Now this act as our new dataset and we need to repeat all the above stepsuntil and unless a low training error is achieved.Suppose with respect to our dataset we have constructed 3 decision trees (DT1, DT2, DT3) in a sequential manner. If we send our test data now it will pass through all the decision trees.

APPLICATIONS:

- AdaBoost algorithm can be used in face detection.
- It is widely used in pattern recognition.

DRAWBACKS:

- Boosting technique learns progressively, it is important to ensure that we have quality data.
- AdaBoost is also extermely sensitive to noise data.

→ Number of user pairs in NOMA is less where as in OMA there are more number of user pairs.

→ System throughput of NOMA is larger than OMA.

~M.Vasanthi

2.Ethical Hacking

1. Introduction:

The Internet is still growing and e-commerce is on its advance. More and more computers get connected to the Internet, wireless devices and networks are booming and sooner or later, nearly every electronic device may have its own IP address. The complexity of networks is increasing, the software on devices gets more complicated and user friendly.

Therefore, Security is a hot topic and quite some effort is spent in securing services, systems and networks. On the internet, there is a silent war going on between the good and the bad guys.between the ones who are trying hard to keep information secured and the ones who are trying to get prohibited access to this information. Securing an information technology environment does not just consist of a bunch of actions which can be taken and then everything can be forgotten. There is no fire and forget solution - security is a never-ending process.

"Ethical hacking describes the process of attacking and penetrating computer systems and networks to Discover and point out potential security weaknesses for a client which is responsible for the attacked Information technology environment1."

2. Ethical Hacking Terminology:

Being able to understand and define terminology is an important part of a CEH's responsibility. This terminology is how security professionals acting as ethical hackers communicate. In this section, we'll discuss a number of terms used in ethical hacking as:

Threat: An environment or situation that could lead to a potential breach of security. Ethical Hackers look for and prioritize threats when performing a security analysis. Malicious hackers and their use of software and hacking techniques are themselves threats to an organization's Information security.

Exploit: A piece of software or technology that takes advantage of a bug, glitch, or vulnerability leading to unauthorized access, privilege escalation, or denial of service on a computer system. Hackers are looking for exploits in computer systems to open the door to an initial Attack. Most exploits are small strings of computer code that, when executed on a system, expose Vulnerability. Experienced hackers create their own exploits, but it is not necessary to have any Programming skills to be an ethical hacker as many hacking software programs have ready-made Exploits.

Vulnerability: The existence of a software flaw, logic design, or implementation error that can Lead to an unexpected and undesirable event executing bad or damaging instructions to the System. Exploit code is written to target vulnerability and cause a fault in the system in order to retrieve valuable data.

Target of Evaluation: A system, program, or network that is the subject of a security Analysis or attack. Ethical hackers are usually concerned with high-value TOEs, systems that Contain sensitive information such as account numbers, passwords, Social Security numbers or other confidential data. It is the goal of the ethical hacker to test hacking tools against the high value TOEs to determine the vulnerabilities and patch them to protect against exploits and Exposure of sensitive data.

Attack: An attack occurs when a system is compromised based on vulnerability. Many attacks are perpetuated via an exploit. Ethical hackers use tools to find systems that may be vulnerable to an Exploit because of the operating system, network configuration, or applications installed on the Systems, and to prevent an attack.

3. ***Hacker:***

In the computer security context, a hacker is someone who seeks and exploits weaknesses in a Computer or computer network. Hackers may be motivated by a multitude of reasons, such as profit, protest, or challenge.

3.1 Types of Hacker:

Hackers can be divided into three groups:

White hats:

White hats are the good guys, the ethical hackers who use their hacking skills for defensive Purposes. White-hat hackers are usually security professionals with knowledge of hacking and the hacker tool set and who use this knowledge to locate weaknesses and implement Countermeasures. White-hat hackers are prime candidates for the exam. White hats are those who hack with permission from the data owner. It is critical to get permission prior to beginning any Hacking activity. This is what makes a security professional a white hat versus a malicious Hacker who cannot be trusted.

Black Hats:

Black hats are the bad guys: the malicious hackers or crackers who use their skills for illegal or malicious purposes. They break into or otherwise violate the system integrity of remote systems,

with malicious intent. Having gained unauthorized access, black-hat hackers destroy vital data, Deny legitimate users service, and just cause problems for their targets. Black-hat hackers and Crackers can easily be differentiated from white-hat hackers because their actions are malicious. This is the traditional definition of a hacker and what most people consider a hacker to be.

Gray Hats:

Gray hats are hackers who may work offensively or defensively, depending on the situation. This is the dividing line between hacker and cracker. Gray-hat hackers may just be interested in Hacking tools and technologies and are not malicious black hats. Gray hats are self-proclaimed Ethical hackers, who are interested in hacker tools mostly from a curiosity standpoint. They may want to highlight security problems in a system or educate victims so they secure.

3.2. Ethical Hackers Versus Cracker:

Ethical hackers are usually security professionals or network penetration testers who use their Hacking skills and toolsets for defensive and protective purposes. Ethical hackers who are Security professionals test their network and systems security for vulnerabilities using the same Tools that a hacker might use to compromise the network. Any computer professional can learn the skills of ethical hacking. The term cracker describes a hacker who uses their hacking skills and toolset for destructive or offensive purposes such as disseminating viruses or performing denial-of-service (DoS) attacks to compromise or bring down systems and networks. No longer just looking for fun, these hackers are sometimes paid to damage corporate reputations or steal or reveal credit card information, while slowing business processes and compromising the integrity of the organization.

4. The job role of an ethical hacker:

Ethical hackers are employed to protect networks and computers from attacks from unethical hackers who illegally penetrate computers to access private and sensitive information. Though they possess technical skills to those of an unethical hacker, an ethical hacker utilizes these skills for protection.

~Sai Anil

3. Cloud Computing

Cloud computing means storing and accessing data and programs over the internet instead of your computer's hard drive .Cloud computing is the dynamic provision of providing hardware, software, or services from third parties over a network. Cloud computing is Internet-based computing, where shared resources, software, & information are provided to computers and other devices on demand. Cloud computing is a computing platform for the next generation of the Internet. Cloud computing is the next natural step in the evolution of on-demand information technology services and products. To a large extent cloud computing will be based on virtualized resources. The idea of cloud computing is based on a very fundamental principal of `reusability of IT capabilities`. The difference that cloud computing brings compared to traditional concepts of computing is to broaden horizons across organizational boundaries.

Cloud computing allows companies to avoid or minimize up-front IT infrastructure costs. Proponents also claim that cloud computing allows enterprises to get their applications up and running faster, with improved manageability and less maintenance, and that it enables IT teams to more rapidly adjust resources to meet fluctuating and unpredictable demand, providing the burst computing capability: high computing power at certain periods of peak demand.

According to the IEEE Computer Society Cloud Computing is:"A paradigm in which information is permanently stored in servers on the Internet and cached temporarily on clients that include desktops, Entertainment centres, table computers, notebooks, wall computers, handhelds, etc."Though many cloud computing architectures and deployments are powered by grids, based on autonomic characteristics and consumed on the basis of utilities billing, the concept of a cloud is fairly distinct and complementary to the concepts of grid, SaaS, Utility Computing etc. In theory, cloud computing promises availability of all required hardware, software, platform, applications, infrastructure and storage with an ownership of just an internet connection. people can access the information that they need from any device with an Internet connection—including mobile and handheld phones—rather than being chained to the desktop.

Characteristics of Cloud Computing:

There are basically 5 essential characteristics of Cloud Computing.

1. **On-demand self-services**: The Cloud computing services does not require any human administrators, user themselves are able to provision, monitor and manage computing resources as needed.

2. **Broad network access**: The Computing services are generally provided over standard networks and heterogeneous devices.

3. **Rapid elasticity**: The Computing services should have IT resources that are able to scale out and in quickly and on as needed basis. Whenever the user require services it is provided to him and it is scale out as soon as its requirement gets over.

4. **Resource pooling**: The IT resource (e.g., networks, servers, storage, applications, and services) present are shared across multiple applications and occupant in an uncommitted manner. Multiple clients are provided service from a same physical resource.

Architecture of cloud computing:

Cloud architecture the systems architecture of the software systems involved in the delivery of cloud computing, comprises hardware and software designed by a cloud architect who typically works for a cloud integrator. It typically involves multiple cloud components communicating with each other over application programming interfaces, usually web services. This closely resembles the Unix philosophy of having multiple programs doing one thing well and working together over universal interfaces.

Complexity is controlled and the resulting systems are more manageable than their monolithic counterparts. Cloud architecture extends to the client, where web browsers and/or software applications access cloud applications. Cloud storage architecture is loosely coupled, where metadata operations are centralized enabling the data nodes to scale into the hundreds, each independently delivering data to applications or users.

Cloud –Types :

There are 4 Different Types of Cloud Computing

1.Public Cloud

2.Private Cloud

3.Hybrid Cloud

4.Community Cloud

1.**Public Cloud**: Public cloud is open to all to store and access information via the Internet using the pay-per-usage method. EX: Amazon elastic compute cloud (EC2), IBM Smart Cloud Enterprise, Microsoft .

2.**Pravite Cloud**: It is used by organizations to build and manage their own data centres internally or by the third party. It can be deployed using Open source tools such as Open stack and Eucalyptus.

3**.Hybrid Cloud**: Hybrid Cloud is a combination of the public cloud and the private cloud. we can say :Hybrid Cloud = Public Cloud + Private Cloud. EX:gmail.

4.**Community Cloud**: Community cloud allows systems and services to be accessible by a group of several organizations to share the information between the organization and a specific community.

~K.Nidheesh Babu

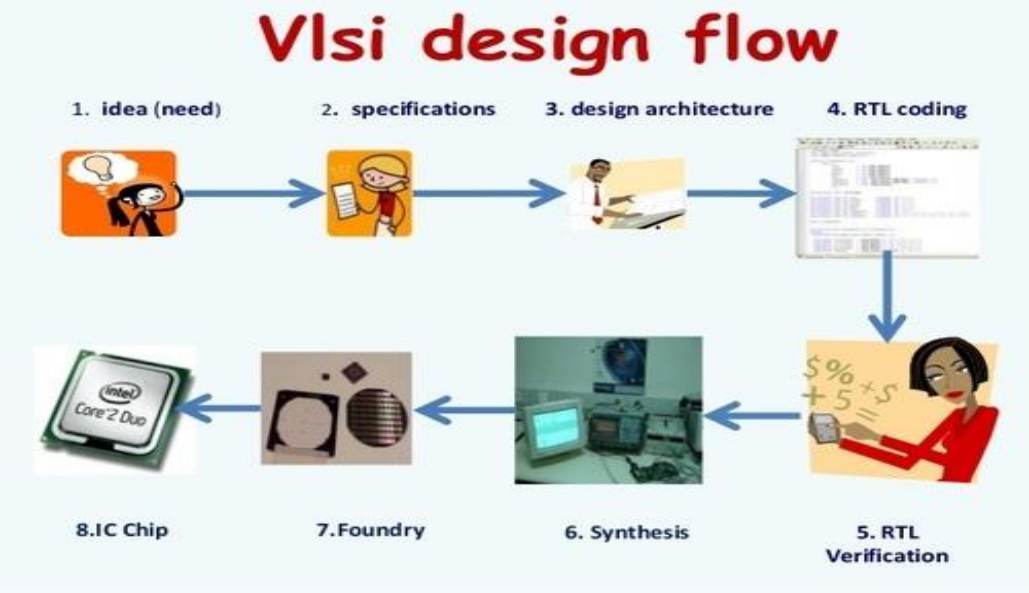
4. VLSI Technology

Introduction :

Integrated circuits are tiny electronic circuit used to perform a specific electronic function, such as amplification. The first integrated circuit was invented by Jack Kilby in 1958. As suggested by moore, the capacity doubled roughly every 18 month. Today, a large single VLSI chip can contain over one billion transistors. These days, VLSI chiefly comprises of front end design and back end design. Front end design includes digital design using HDL and design verification through simulation and other techniques. The backend design comprises of CMOS library design and its characterization. It also covers the physical design and fault simulation.

VLSI Design Methodologies:

The design methodology implies the complete process of creating a VLSI design. Following steps shows various steps involved in creating a VLSI design from concept to the final product.



System Specification And Architectural Design :

VLSI design cycle start with a formal specification of a VLSI chip. At this stage, the system specifications are laid out. This involves a high level representation of the system.

Function Design:

In this stage, main functional units of the system and the interconnect requirements between the units are identified. The main purpose of this stage is to specify system behavior, in terms of

Input, Output, and Timing of each unit. The outcome of functional design is usually a diagram showing relationship of time and other aspects between units.

Logic Design:

In this stage, the logic for the VLSI system is designed. This includes, Boolean expressions, control flow, word width, register allocation, etc. The outcome of this stage is register transfer level description. RTL is expressed in a hardware description language like VHDL and Verilog.

Circuit Design:

The purpose of the circuit design is to develop a circuit representation based on the logic design. The outcome of this stage is a netlist. Netlist is an electronic circuit system consisting of all of the circuit element names designators, listed in a format with their input and output signal names.

Fabrication :

Fabrication process includes lithography, polishing, deposition, diffusion, etc. This process consist of several steps and requires various masks. Before the chip is mass produced, a prototype is made and tested.

Packaging:

Packaging involves putting together the chips on a printed circuit board or a multi chip module.

Rtl Coding:

RTL-register transfer level

This implies that the VHDL/VERILOG code written based on the architecture describes how data is transformed as it is passed from register to register.

RTL Coding tools

- Xilinx ise,
- Vim,
- Emacs,
- ConTEXT,
- HDL Turbo Writer

RTL Verification:

RTL simulation and verification is one of the important step. This ensures that the design is logically correct and without major timing errors. It is advantageous to perform this step, especially in the early stages of the design.

RTL Verification Tools

- Modelsim
- Xilinx ise

- Verilog-XL

Synthesis:

This is where the design now start to get physical. Logic synthesis is a process by which the desired circuit behavior i.e register transistor level is turned into a design in terms of logic gates which drives the circuit or architecture.

Synthesis tools:

FPGA(Altera ,digiland ,Xilinx)

CPLD(altera, digiland)

Foundry:

The design is sent for fabrication for mass production to foundry.

Advantages :

- Reduces the size of circuits
- Reduces the effective cost of the devices.
- Increases the operating speed of circuits.
- Requires less power than discrete components.
- Higher reliability.

Disadvantages:

- Large latency and higher energy dissipation.
- Number of device integrated is limited by interposer size. Challenges of metallic interconnects persist.
- Higher heat dissipation density and less reliable TSV-based fabrication.
- Requires physical waveguide design.
- Fabrication and CMOS integration of CNT with desired properties is challenging.

~B.Avinash

5. 5G communication Technology

In telecommunications, 5G is the fifth generation technology standard for broadband cellular networks, which cellular phone companies began deploying worldwide in 2019, and is the planned successor to the 4G networks which provide connectivity to most current cellphones. 5G networks are predicted to have more than 1.7 billion subscribers worldwide by 2025, according to the GSM Association. Like its predecessors, 5G networks are cellular networks, in which the service area is divided into small geographical areas called *cells*. All 5G wireless devices in a cell are connected to the Internet and telephone network by radio waves through a local antenna in the cell. The main advantage of the new networks is that they will have greater bandwidth, giving higher download speeds, eventually up to 10 gigabits per second (Gbit/s).

In addition to 5G being faster than existing networks, 5G can connect more different devices, and even if people are in crowded areas, the servers will be more unified, improving the quality of Internet services. Due to the increased bandwidth, it is expected the networks will increasingly be used as general internet service providers (ISPs) for laptops and desktop computers, competing with existing ISPs such as cable internet, and also will make possible new applications in internet-of-things (IoT) and machine-to-machine areas. Cellphones with 4G capability alone are not able to use the new networks, which require 5G-enabled wireless devices.

5G networks are cellular networks, in which the service area is divided into small geographical areas called *cells*. All 5G wireless devices in a cell communicate by radio waves with a cellular base station via fixed antennas, over frequency channels assigned by the base station. The base stations, termed gNodeBs, are connected to switching centers in the telephone network and routers for Internet access by high-bandwidth optical fiber or wireless backhaul connections. As in other cellular networks, a mobile device moving from one cell to another is automatically handed off seamlessly to the current cell. 5G can support up to a million devices per square kilometer, while 4G supports only one-tenth of that capacity.

Several network operators use millimeter waves called FR2 in 5G terminology, for additional capacity and higher throughputs. Millimeter waves have a shorter range than microwaves, therefore the cells are limited to a smaller size. Millimeter waves also have

more trouble passing through building walls. Millimeter-wave antennas are smaller than the large antennas used in previous cellular networks. Some are only a few centimeters long.

The increased speed is achieved partly by using additional higher-frequency radio waves in addition to the low- and medium-band frequencies used in previous cellular networks. However, higher-frequency radio waves have a shorter useful physical range, requiring smaller geographic cells. For wide service, 5G networks operate on up to three frequency bands – low, medium, and high.

5G can be implemented in low-band, mid-band or high-band millimeter-wave 24 GHz up to 54 GHz. Low-band 5G uses a similar frequency range to 4G cellphones, 600–900 MHz, giving download speeds a little higher than 4G: 30–250 megabits per second (Mbit/s). Low-band cell towers have a range and coverage area similar to 4G towers. Mid-band 5G uses microwaves of 2.3–4.7 GHz, allowing speeds of 100–900 Mbit/s, with each cell tower providing service up to several kilometers in radius. This level of service is the most widely deployed, and was deployed in many metropolitan areas in 2020. Some regions are not implementing the low band, making Mid-band the minimum service level. High-band 5G uses frequencies of 24–47 GHz, near the bottom of the millimeter wave band, although higher frequencies may be used in the future. It often achieves download speeds in the gigabit-per-second (Gbit/s) range, comparable to cable internet. However, millimeter waves (mmWave or mmW) have a more limited range, requiring many small cells.[5] They can be impeded or blocked by materials in walls or windows. Due to their higher cost, plans are to deploy these cells only in dense urban environments and areas where crowds of people congregate such as sports stadiums and convention centers. The above speeds are those achieved in actual tests in 2020, and speeds are expected to increase during rollout. The spectrum ranging from 24.25–29.5 GHz has been the most licensed and deployed 5G mmWave spectrum range in the world.

The industry consortium setting standards for 5G is the 3rd Generation Partnership Project (3GPP). It defines any system using 5G NR (5G New Radio) software as "5G", a definition that came into general use by late 2018. Minimum standards are set by the International Telecommunication Union (ITU).

~K.Ramya Sri

Editorial

Another year is passing out with carry forwarded pains and economic difficulties due to covid. Many were affected, few were diseased and many are still struggling to get adjusted. Irrespective of all odds, life has to continue with a ray of hope that everything will settle down to normalcy. That small hope can make you survive , take you to topmost position. Mar's colony , reminding ant's colony algorithm is the idea came into the mind of Elon Musk, the owner of Tesla, years ago. With that small thought and in a way to achieve revenue , he established Space-X for launching satellites and which is currently having shuttles to ISS. With that idea he initiated star link program to provide uninterrupted net facilities to remote areas. That should be the attitude of each which does not mean each should start space X. Have a new goal, try hard to achieve it and become the leader.

Happy New year to all

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