ELECTRONICS & COMMUNICATION ENGINEERING

TECH CONNECT

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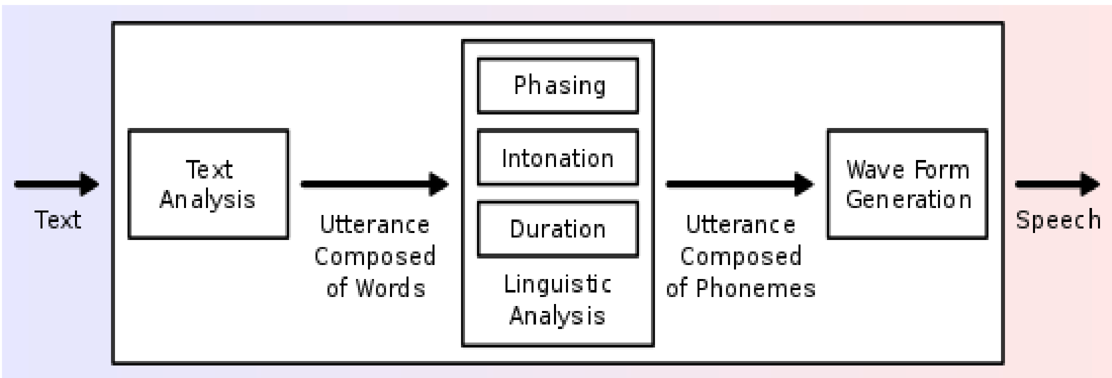
Contents

1. *Speech Synthesis*

Speech synthesis is the process of generating spoken language by machine on the basis of written input. Speech synthesis is the computer-generated simulation of human speech. It is used to translate written information into aural information where it is more convenient, especially for mobile applications such as voice-enabled e-mail and unified messaging . It is also used to assist the vision-impaired so that, for example, the contents of a display screen can be automatically read aloud to a blind user. Speech synthesis is the counterpart of speech or voice recognition . The earliest speech synthesis effort was in 1779 when Russian Professor Christian Kratzenstein created an apparatus based on the human vocal tract to demonstrate the physiological differences involved in the production of five long vowel sounds. The first fully functional voice synthesizer, Homer Dudley's VODER (Voice Operating Demonstrator), was shown at the 1939 World's Fair. The VODER was based on Bell Laboratories' vocoder (voice coder) research of the mid-thirties.

Speech synthesis is the artificial production of human speech. A computer system used for this purpose is called a speech computer or speech synthesizer, and can be implemented in software or hardware products. The quality of a speech synthesizer is judged by its similarity to the human voice and by its ability to be understood clearly. An intelligible text-to-speech program allows people with visual impairments or reading disabilities to listen to written words on a home computer. Many computer operating systems have included speech synthesizers since the early 1990s.



APPLICATIONS:

Probably the most important and useful application field in speech synthesis is the reading and communication aids for the blind. Before synthesized speech, specific audio books were used where the content of the book was read into audio tape. It is clear that making such spoken copy of any large book takes several months and is very expensive. It is also easier to get information from computer with speech instead of using special bliss symbol keyboard, which is an interface for reading the Braille characters.

Speech synthesis is currently used to read www-pages or other forms of media with normal personal computer. Information services may also be implemented through a normal telephone interface with keypad-control similar to text-tv. With modern computers it is also possible to add new features into reading aids. It is possible to implement software to read standard check forms or find the information how the newspaper article is constructed. However, sometimes it may be impossible to find correct construction of the newspaper article if it is for example divided in several pages or has an anomalous structure.

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17761A0416

2.Smart Ambulance

In recent years, road traffic has been increased rapidly which results in occurrence many accidents. Ambulance are used to take the injured persons to the nearby hospitals. But in some cases, there is loss of life due to the delay in the arrival of ambulance to the hospital in the golden hour. This delay is mainly cause by the waiting of the ambulance in the traffic signals. Hence to reduce this problem, we introduce a new design for automatically controlling the traffic signals which makes the traffic signals ON in the way of ambulance, so that it would be able to cross all the traffic junctions without waiting. To achieve this task, we use a GSM modem which is connected to all traffic junctions and these are controlled by main server by sending the control messages to their GSM modems. The GPS coordinates of all these traffic junctions are stored in the database by which the ambulance is guided to the hospital in the shortest way.

In some designs, the server also determines the location of the accident spot through the sensor systems in the vehicle which encountered the accident. The main server finds the nearest ambulance to the accident spot and also the shortest path between the ambulance, accident spot and the nearest hospital and sends this path to the ambulance.

According to our system, every vehicle should contain vibration sensor, controller, siren, GPS system and a GSM module. The vibration sensor used in the vehicle will continuously sense for any large scale vibrations in the vehicle. The sensed data is given to the controller which compares it with a threshold value and if it equals or exceeds that, then the controller will automatically switches on the siren inside the vehicle.

In case of minor accident, the injure person would not need the service of ambulance and can switch off the siren before the timer counts to zero else if he is unconscious or wounded badly , he needs an ambulance then the siren is left ON and when the timer counts to zero, it would trigger both the GSM MODULE and the GPS system inside the vehicle. The GPS system finds out the current position of the vehicle(location of the accident spot) and gives that data to GSM module. The GSM module sends this data to the main server which sends the location to the nearest ambulance. In this method, the SMART AMBULANCE will work and can save many lives by providing immediate treatment.

~V. Durga (15761A055)

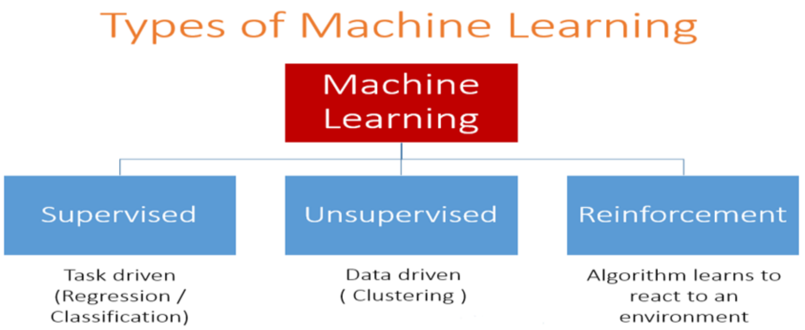
3. *Machine Learning*

Introduction:

Over the past two decades Machine Learning has become one of the mainstays of information technology and with that, a rather central, albeit usually hidden, part of our life. With the ever increasing amounts of data becoming available there is good reason to believe that smart data analysis will become even more pervasive as a necessary ingredient for technological progress. The purpose of this chapter is to provide the reader with an overview over the vast range of applications which have at their heart a machine learning problem and to bring some degree of order to the zoo of problems. After that, we will discuss some basic tools from statistics and probability theory, since they form the language in which many machine learning problems must be phrased to become amenable to solving. Finally, we will outline a set of fairly basic yet effective algorithms to solve an important problem, namely that of classification. More sophisticated tools, a discussion of more general problems and a detailed analysis will follow in later parts of the book.

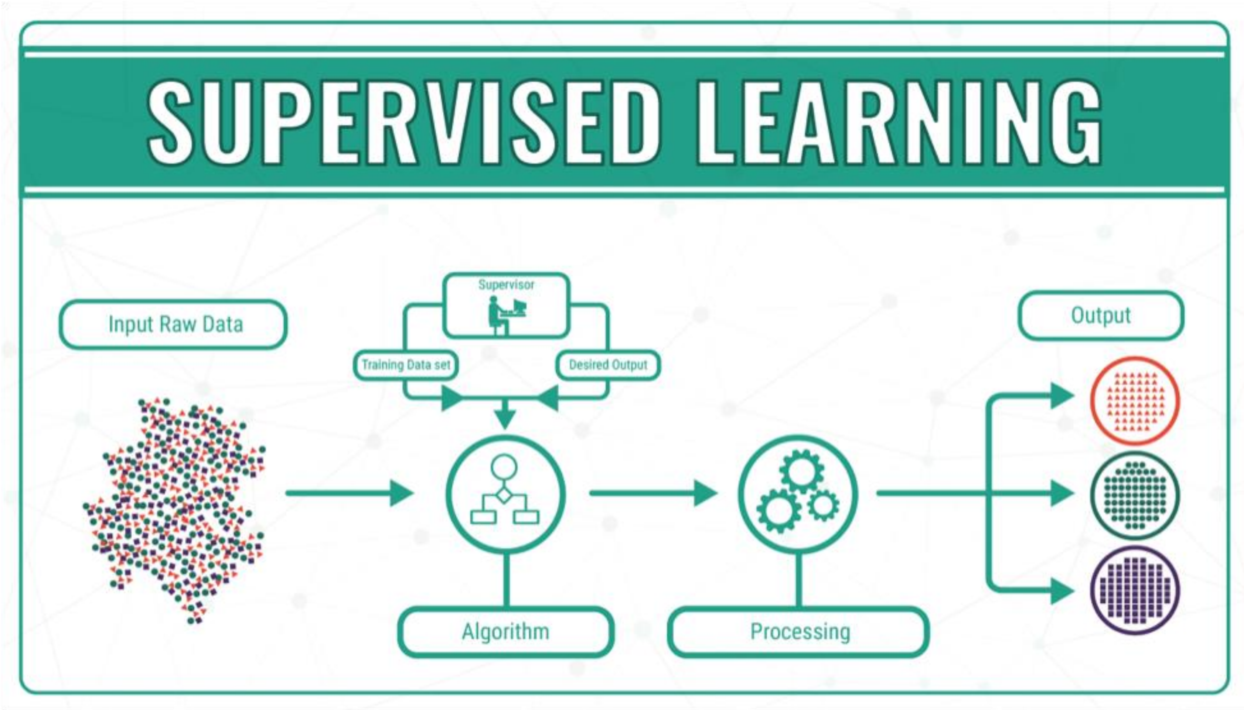
A Need of Machine Learning:

Machine learning can appear in many guises. We now discuss a number of applications, the types of data they deal with, and finally, we formalize the problems in a somewhat more stylized fashion. The latter is key if we want to avoid reinventing the wheel for every new application. Instead, much of the art of machine learning is to reduce a range of fairly disparate problems to a set of fairly narrow prototypes. Much of the science of machine learning is then to solve those problems and provide good guarantees for the solutions.



Supervised Learning

These algorithms are trained using labeled examples, in different scenarios, as an input where the desired outcome is already known. Equipment, for instance, could have data points such as "F" and "R" where "F" represents "failed" and "R" represents "runs". A learning algorithm will receive a set of input instructions along with the corresponding accurate outcomes. The learning algorithm will then compare the actual outcome with the accurate outcome and flag an error, if there is any discrepancy. Using different methods, such as regression, classification, gradient boosting, and prediction, supervised learning uses different patterns to proactively predict the values of a label on extra unlabeled data. This method is commonly used in areas where historical data is used to predict events that are likely to occur in the future. For instance, anticipate when a credit card transaction is likely to be fraudulent or predict which insurance customers are likely to file their claims.



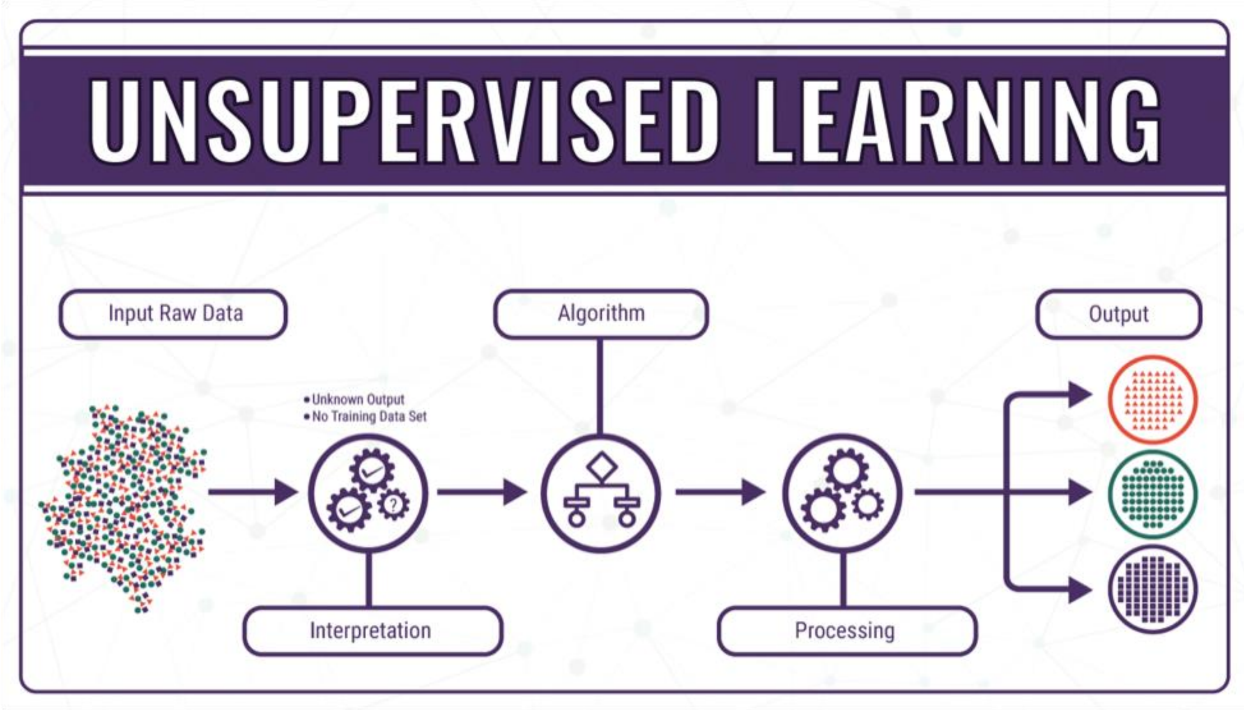
Unsupervised Learning

This method of ML finds its application in areas were data has no historical labels. Here, the system will not be provided with the "right answer" and the algorithm should identify what is being shown. The main aim here is to analyze the data and identify a pattern and structure within the available data set. Transactional data serves as a good source of data set for unsupervised learning.

For instance, this type of learning identifies customer segments with similar attributes and then lets the business to treat them similarly in marketing campaigns. Similarly, it can also identify attributes that differentiate customer segments from one another. Either ways, it is about identifying a similar structure in the available data set. Besides, these algorithms can also identify outliers in the available data sets.

Some of the widely used techniques of unsupervised learning are -

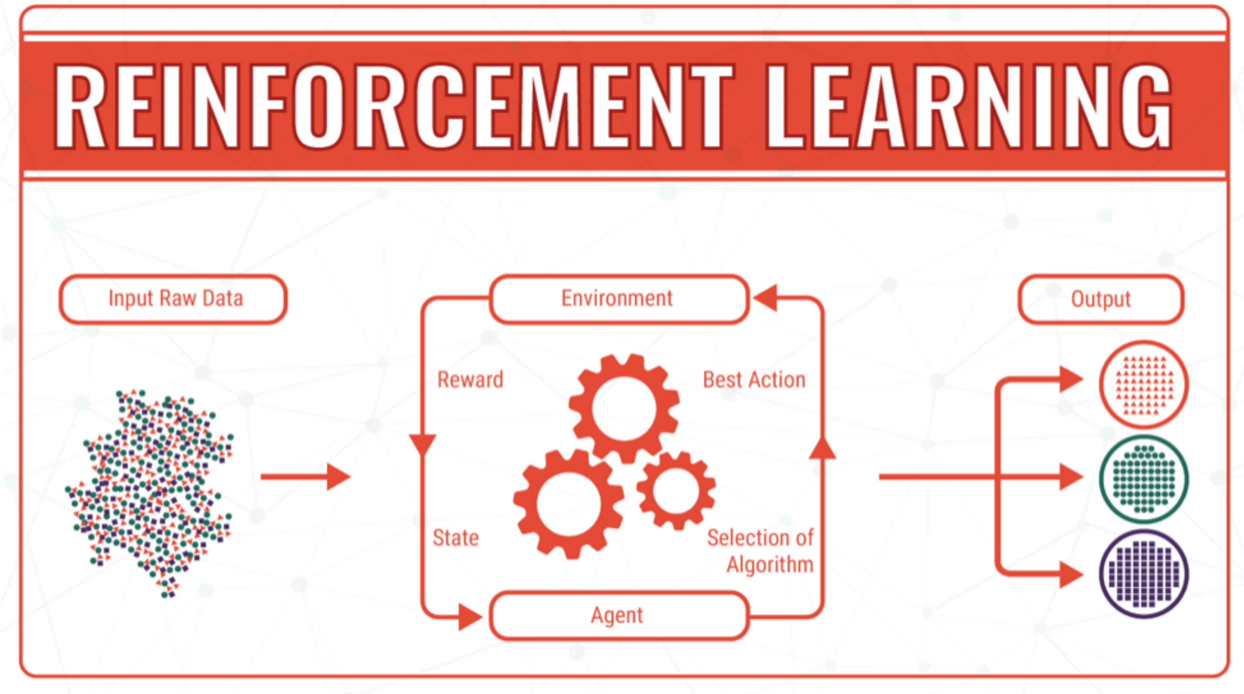
- k-means clustering
- self-organizing maps
- value decomposition
- mapping of nearest neighbor



Reinforcement Learning

This is mainly used in navigation, robotics and gaming. Actions that yield the best rewards are identified by algorithms that use trial and error methods. There are three major components in reinforcement learning, namely, the agent, the actions and the environment. The agent in this case is the decision maker, the actions are what an agent does, and the environment is anything that an agent interacts with. The main aim in this kind of learning is to select the actions that maximize the reward, within a specified time. By following a good policy, the agent can achieve the goal faster.

Hence, the primary idea of reinforcement learning is to identify the best policy or the method that helps businesses in achieving the goals faster. While humans can create a few good models in a week, machine learning is capable of developing thousands of such models in a week.



Applications of Machine Learning:

The value of machine learning technology has been recognized by companies across several industries that deal with huge volumes of data. By leveraging insights obtained from this data, companies are able work in an efficient manner to control costs as well as get an edge over their competitors. This is how some sectors / domains are implementing machine learning -

- **Financial Services**

  Companies in the financial sector are able to identify key insights in financial data as well as prevent any occurrences of financial fraud, with the help of machine learning technology. The technology is also used to identify opportunities for investments and trade. Usage of cyber surveillance helps in identifying those individuals or institutions which are prone to financial risk, and take necessary actions in time to prevent fraud.

- **Government**

  Government agencies like utilities and public safety have a specific need FOR Ml, as they have multiple data sources, which can be mined for identifying useful patterns and insights. For example sensor data can be analyzed to identify ways to minimize costs and increase efficiency. Furthermore, ML can also be used to minimize identity thefts and detect fraud.

- **Healthcare**

  With the advent of wearable sensors and devices that use data to access health of a patient in real time, ML is becoming a fast-growing trend in healthcare. Sensors in wearable provide real-time patient information, such as overall health condition, heartbeat, blood pressure and other vital parameters. Doctors and medical experts can use this information to analyze the health condition of an individual, draw a pattern from the patient history, and predict the occurrence of any ailments in the future. The technology also empowers medical experts to analyze data to identify trends that facilitate better diagnoses and treatment.

- **Transportation**

  Based on the travel history and pattern of traveling across various routes, machine learning can help transportation companies predict potential problems that could arise on certain routes, and accordingly advise their customers to opt for a different route. Transportation firms and delivery organizations are increasingly using machine learning technology to carry out data analysis and data modeling to make informed decisions and help their customers make smart decisions when they travel.

- **Oil and Gas**

  This is perhaps the industry that needs the application of machine learning the most. Right from analyzing underground minerals and finding new energy sources to streaming oil distribution, ML applications for this industry are vast and are still expanding.

~N.Jahnavi (17761A0438)

4. Brain and Corpus Callosum

Introduction

The brain is one of the most complex and magnificent organs in the human body. Our brain gives us awareness of ourselves and of our environment, processing a constant stream of sensory data. It controls our muscle movements, the secretions of our glands, and even our breathing and internal temperature. Every creative thought, feeling, and plan is developed by our brain. The brain's neurons record the memory of every event in our lives. In fact, the human brain is so complicated that it remains an exciting frontier in the study of the body; doctors, psychologists, and scientists are continually endeavoring to learn exactly how the many structures of the brain work together intricately to create our powerful human mind.

Anatomy of the Brain

There are different ways of dividing the brain anatomically into regions. Let's use a common method and divide the brain into three main regions based on embryonic development: the forebrain, midbrain and hindbrain. Under these divisions:

The forebrain is made up of our incredible cerebrum, thalamus, hypothalamus and pineal gland among other features. Neuro-anatomists call the cerebral area the telencephalon and use the term diencephalon (or interbrain) to refer to the area where our thalamus, hypothalamus and pineal gland reside. The midbrain located near the very center of the brain between the interbrain and the hindbrain, is composed of a portion of the brainstem. The hindbrain consists of the remaining brainstem as well as our cerebellum and pons. Neuroanatomists have a word to describe the brainstem sub-region of our hindbrain, calling it the myelencephalon, while they use the word metencephalon in reference to our cerebellum and pons collectively.

The tissue of the brain can be broken down into two major classes: gray matter and white matter.

Gray matter is made of mostly unmyelinated neurons, most of which are interneurons. The gray matter regions are the areas of nerve connections and processing. White matter is made of mostly myelinated neurons that connect the regions of gray matter to each other and to the rest of the body. Myelinated neurons transmit nerve signals much faster than unmyelinated axons do. The white matter acts as the information highway of the brain to speed the connections between distant parts of the brain and body.

Corpus callosum

The brain is divided into a right and left hemisphere, and the two halves are connected by the corpus callosum. The corpus callosum (from Latin: "tough body"), also known as the colossal commissure, is a wide, flat bundle of neural fibers beneath the cortex in the eutherian brain at the longitudinal fissure. It connects the left and right cerebral hemispheres and facilitates interhemispheric communication. It is the largest white matter structure in the brain, and it contains a high myelin content, which facilitates quicker transmission of information. This bundle of neural tissue features over 200 million axons by rough estimate. This should not be confused with grey matter. The brain uses grey matter for computation, thinking, memory storage, and more. White matter, like the corpus callosum, allows different parts of the brain to communicate with each other. Some congenital defects include a complete lack of this neural tissue. In recent history, some surgeons have surgical cut it as a means for treating epileptic seizures. By disrupting contact between the two brain hemispheres, a seizure can be isolated and kept from spreading.

Structure

The posterior (back) portion of the corpus callosum is called the splenium; the anterior (front) is called the genu (or "knee"); between the two is the truncus, or "body", of the corpus callosum. The part between the body and the splenium is often markedly narrowed and thus referred to as the "isthmus". The rostrum is the part of the corpus callosum that projects posteriorly and inferiorly from the anterior most genu, as can be seen on the sagittal image of the brain displayed on the right. The rostrum is so named for its resemblance to a bird's beak.On either side of the corpus callosum, the fibers radiate in the white matter and pass to the various parts of the cerebral cortex; those curving forward from the genu into the frontal lobe constitute the forceps anterior, and those curving backward into the occipital lobe, the forceps posterior. Between these two parts is the main body of the fibers which constitute the tapetum and extend laterally on either side into the temporal lobe, and cover in the central part of the lateral ventricle.

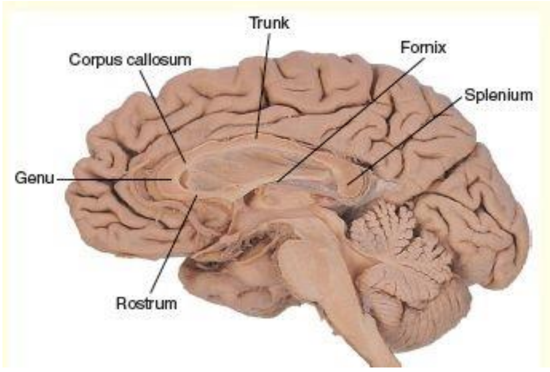


Fig. Corpus callosum

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Thinner axons in the genu connect the prefrontal cortex between the two halves of the brain; these fibres arise from a fork-like bundle of fibers from the tapetum, the forceps anterior. Thicker axons in the mid body, or trunk of the corpus callosum, interconnect areas of the motor cortex, with proportionately more of the corpus callosum dedicated to supplementary motor regions including Broca's area. The posterior body of the corpus, known as the splenium, communicates somatosensory information between the two halves of the parietal lobe and the visual cortex at the occipital lobe, these are the fibres of the forceps posterior.

Function

The corpus callosum is involved in several functions of the body including:

- Communication Between Brain Hemispheres
- Eye Movement
- Maintaining the Balance of Arousal and Attention
- Tactile Localization

Agenesis of the corpus callosum (ACC)

Agenesis of the corpus callosum (ACC) is a rare congenital disorder that is one of the most common brain malformations observed in the humans, in which the corpus callosum is partially or completely absent. ACC is usually diagnosed within the first two years of life, and may manifest as a severe syndrome in infancy or childhood, as a milder condition in young adults, or as an asymptomatic incidental finding. Initial symptoms of ACC usually include seizures, which may be followed by feeding problems and delays in holding the head erect, sitting, standing, and walking. Other possible symptoms may include impairments in mental and physical development, hand-eye coordination, and visual and auditory memory. Hydrocephaly may also occur. In mild cases, symptoms such as seizures, repetitive speech, or headaches may not appear for years.

ACC is usually not fatal. Treatment usually involves management of symptoms, such as hydrocephaly and seizures, if they occur. Although many children with the disorder lead normal lives and have average intelligence, careful neuropsychological testing reveals subtle differences in higher cortical function compared to individuals of the same age and education without ACC. Children with ACC accompanied by developmental delay and/or seizure disorders should be screened for metabolic disorders.

ACC can occur as an isolated condition or in combination with other cerebral abnormalities, including Arnold-Chiari malformation, Dandy-Walker syndrome, Andermann syndrome, schizencephaly (clefts or deep divisions in brain tissue), and holoprosencephaly (failure of the forebrain to divide into lobes.) Girls may have a gender-specific condition called Aicardi's syndrome, which causes severe mental retardation, seizures, abnormalities in the vertebra of the spine, and lesions on the retina of the eye. ACC can also be associated with malformations in other parts of the body, such as midline facial defects. The effects of the disorder range from subtle or mild to severe, depending on associated brain abnormalities. Intelligence may be normal with mild compromise of skills requiring matching of visual patterns.

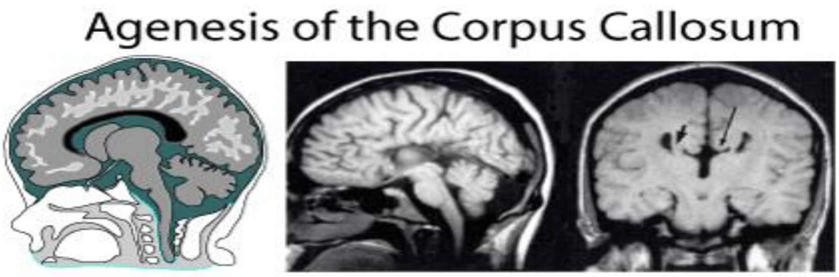

Fig. MRI Image depicting sizes of normal and agenesis -corpus callosum

In addition to agenesis of the corpus callosum, similar conditions are hypogenesis (partial formation), dysgenesis (malformed), and hypoplasia (underdevelopment, including too thin).Recent studies have also linked possible correlations between corpus callosum malformation and autism spectrum disorders.

Sexual dimorphism

The corpus callosum and its relation to sex has been a subject of debate in the scientific and lay communities for over a century. Initial research in the early 20th century claimed the corpus to be different in size between men and women. That research was in turn questioned, and ultimately gave way to more advanced imaging techniques that appeared to refute earlier correlations. However, advanced analytical techniques of computational neuroanatomy developed in the 1990s showed that sex differences were clear but confined to certain parts of the corpus callosum, and that they correlated with cognitive performance in certain tests. One recent study using magnetic resonance imaging (MRI) found that the midsagittal corpus callosum cross-sectional area is, on average, proportionately larger in females.

~G.L.N.Murthy (Associate Professor)

5. Medical Imaging

Medical imaging is a tool for creating visual representations of the interior of a body for clinical analysis and medical intervention. Patients and medical professionals alike have great interest in the development of methods which are reliable and reproducible. Thus, in a field which traditionally has relied on the trained eye of a specialist to make diagnoses from a qualitative perspective, a transition is underway: computer-aided diagnosis is now possible with digitized imaging. It is known to be a powerful tool for increasing the reliability and reproducibility of disease diagnostics. It provides the pathologists, quantitative data from histological images which supplement the qualitative data. A novel method for analyzing the surface area and volume of corpus callosum can be developed using Gaussian mixture model and Fuzzy C means as an example of the use of image processing in aid of diagnostics.

Medical imaging seeks to reveal internal structures hidden by the skin and bones, as well as to diagnose and treat a disease. It also establishes a database of normal anatomy and physiology to make it possible to identify any physical or mental abnormalities. As a discipline and in its widest sense, it is part of biological imaging and incorporates radiology which uses the imaging technologies of X-ray radiography, magnetic resonance imaging, medical ultrasonography or ultrasound, endoscopy, elastography, tactile imaging, thermography, medical photography and nuclear medicine functional imaging techniques as positron emission tomography. Measurement and recording techniques which are not primarily designed to produce images, such as electroencephalography (EEG), magnetoencephalography (MEG), electrocardiography (ECG), and others represent other technologies which produce data representation as a parameter graph vs. time or maps which contain information about the measurement locations. In a limited comparison these technologies can be considered as forms of medical imaging in another discipline. Up until 2010, 5 billion medical imaging studies had been conducted worldwide. Radiation exposure from medical imaging in 2006 made up about 50% of total ionizing radiation exposure in the United States. In the clinical context, invisible light medical imaging is generally equated to radiology or clinical imaging and the medical practitioner responsible for interpreting (and sometimes acquiring) the images is a radiologist. Visible light medical imaging involves digital video or still pictures that can be seen without special equipment. Dermatology and wound care are two modalities that use visible light imagery. Diagnostic radiography designates the technical aspects of medical imaging and in particular the acquisition of medical images. The radiographer or radiologic technologist is usually responsible for acquiring medical images of diagnostic quality, although some radiological interventions are performed by radiologists. While radiology is an evaluation of anatomy, nuclear medicine provides functional assessment.

As a field of scientific investigation, medical imaging constitutes a sub-discipline of biomedical engineering, medical physics or medicine depending on the context: Research and development in the area of instrumentation, image acquisition (e.g. radiography), modeling and quantification are usually the preserve of biomedical engineering, medical physics, and computer science; Research into the application and interpretation of medical images is usually the preserve of radiology and the medical sub-discipline relevant to medical condition or area of medical science (neuroscience, cardiology, psychiatry, psychology, etc.) under investigation. Many of the techniques developed for medical imaging also have scientific and industrial applications. Medical imaging is often perceived to designate the set of techniques that noninvasively produce images of the internal aspect of the body. In this restricted sense, medical imaging can be seen as the solution of mathematical inverse problems. This means that cause (the properties of living tissue) is inferred from effect (the observed signal). In the case of medical ultrasonography, the probe consists of ultrasonic pressure waves and echoes that go inside the tissue to show the internal structure. In the case of projectional radiography, the probe uses X-ray radiation, which is absorbed at different rates by different tissue types such as bone, muscle and fat.

6.Image Compression

Image compression is a type of data compression applied to digital images, to reduce their cost for storage or transmission. Algorithms may take advantage of visual perception and the statistical properties of image data to provide superior results compared with generic compression methods.

LOSSY AND LOSSLESS IMAGE COMPRESSION

Image compression may be lossy or lossless. Lossless compression is preferred for archival purposes and often for medical imaging, technical drawings, clip art, or comics. Lossy compression methods, especially when used at low bit rates, introduce compression artifacts. Lossy methods are especially suitable for natural images such as photographs in applications where minor (sometimes imperceptible) loss of fidelity is acceptable to achieve a substantial reduction in bit rate. Lossy compression that produces negligible differences may be called visually lossless.

METHODS OF LOSSLESS IMAGE COMPRESSION:

- Run-length encoding – used in default method in PCX and as one of possible in BMP, TGA, TIFF
- Area image compression
- DPCM and Predictive Coding
- Entropy encoding
- Adaptive dictionary algorithms such as LZW – used in GIF and TIFF
- DEFLATE – used in PNG, MNG, and TIFF
- Chain codes

METHODS OF LOSSY IMAGE COMPRESSION:

- Reducing the color space to the most common colors in the image. The selected colors are specified in the color palette in the header of the compressed image. Each pixel just references the index of a color in the color palette, this method can be combined with dithering to avoid posterisation.
- Transform coding. This is the most commonly used method. In particular, a Fourier-related transform such as the Discrete Cosine Transform (DCT) is widely used. The DCT is sometimes referred to as "DCT-II" in the context of a family of discrete cosine transforms; e.g., see discrete cosine transform. The more recently developed wavelet transform is also used extensively, followed by quantization and entropy coding.
- Fractal compression.

PROPERTIES OF IMAGE COMPRESSION

The best image quality at a given compression rate (or bit rate) is the main goal of image compression; however, there are other important properties of image compression schemes:

Scalability generally refers to a quality reduction achieved by manipulation of the bitstream or file (without decompression and re-compression). Other names for scalability are progressive coding or embedded bit streams. Despite its contrary nature, scalability also may be found in lossless codes, usually in form of coarse-to-fine pixel scans. Scalability is especially useful for previewing images while downloading them (e.g., in a web browser) or for providing variable quality access to e.g., databases. There are several types of scalability:

- Quality progressive or layer progressive: The bitstream successively refines the reconstructed image.

- Resolution progressive: First encode a lower image resolution; then encode the difference to higher resolutions.
- Component progressive: First encode grey-scale version; then adding full color.

Meta information, Compressed data may contain information about the image which may be used to categorize, search, or browse images. Such information may include color and texture statistics, small preview images, and author or copyright information.

Processing power, Compression algorithms require different amounts of processing power to encode and decode. Some high compression algorithms require high processing power.

The quality of a compression method often is measured by the peak signal-to-noise ratio. It measures the amount of noise introduced through a lossy compression of the image, however, the subjective judgment of the viewer also is regarded as an important measure, perhaps, being the most important measure.

NECESSITY OF IMAGE COMPRESSION

Digital images are very large in size and hence occupy larger storage space. Due to their larger size, they take larger bandwidth and more time for upload or download through the Internet. This makes it inconvenient for storage as well as file sharing. To combat with this problem, the images are compressed in size with special techniques. This compression not only helps in saving storage space but also enables easy sharing of files. Image compression applications reduce the size of an image file without causing major degradation to the quality of the image.

APPLICATIONS OF IMAGE COMPRESSION

Image compression applications make use of various techniques and algorithms in compressing images. The techniques thus used by image compression applications can be classified as lossless and lossy compression. The method of compression used depends on the desired quality of output. If the image compression application is expected to produce a very high quality output without any loss in fidelity, lossless compression technique is used. This technique is used where a high degree of accuracy is a must. In applications where some quality can be compromised, lossy compression technique is used. In lossy compression, there is minor loss of quality, but the loss is too little to be visible. This technique is used in applications where a little compromise on quality of image is acceptable.

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7.Image Segmentation

Introduction:

Image segmentation is the division of an image into regions or categories, which correspond to different objects or parts of objects. Every pixel in an image is allocated to one of a number of these categories.

A good segmentation is typically one in which:

• Pixels in the same category have similar greyscale of multivariate values and form a connected region,

• Neighbouring pixels which are in different categories have dissimilar values.

What is the need of Image segmentation?

Image segmentation is a vital part of image analysis process. It differentiates between the objects we want to inspect further and the other objects or their background. In order to find meaning from an image, image segmentation makes everything easier than finding meaning from pixels.

APPROACHES TO SEGMENTATION:

There are three general approaches to segmentation:

- Thresholding
- edge-based methods
- region-based methods.

  - In thresholding, pixels are allocated to categories according to the range of values in which a pixel lies
  - In edge-based segmentation, an edge filter is applied to the image, pixels are classified as edge or non-edge depending on the filter output, and pixels which are not separated by an edge are allocated to the same category.
  - Finally, region-based segmentation algorithms operate iteratively by grouping together pixels which are neighbors and have similar values and splitting groups of pixels which are dissimilar in value.

• Methods within each approach may be further divided into those which:

– require manual intervention, or

– are fully automatic.

Thresholds may be obtained by:

• Manual choice, or

• applying an algorithm such as intermeans or minimum-error to the histogram of pixel values.

– Intermeans positions t half-way between the means in the two categories.

– Minimum-error chooses t to minimize the total number of misclassifications on the assumption that pixel values in each category are normally distributed.

• Thresholding methods may also be applied to multivariate images. In this case, two possibilities are:

– Manually selecting a training set of pixels which are representative of the different categories, and then using linear discrimination,

– K-means clustering, in which the categories are selected automatically from the data.

• The context of a pixel, that is the values of neighbouring pixels, may also be used to modify the threshold value in the classification process.

We considered three methods:

– restricting the histogram to those pixels which have similarly valued neighbors,

– Post-classification smoothing,

– using Bayesian image restoration methods, such as the iterated conditional modes (ICM) algorithm.

In edge-based segmentation:

All pixels are initially labeled as either being on an edge or not, then non-edge pixels which form connected regions are allocated to the same category.

Edge labeling may be:

• Manual, by using a computer mouse to control a screen cursor and draw boundary lines between regions,

• Automatic, by using an edge-detection filter. Edges can be located either: – where output from a filter such as Prewitt's exceeds a threshold, or – at zero crossings from a Laplacian-of-Gaussian filter.

Region-based:

Algorithms act by grouping neighbouring pixels which have similar values and splitting groups of pixels which are heterogeneous in value.

Three methods were considered:

• Regions may be grown from manually-positioned 'seed' points, for example, by applying a watershed algorithm to output from Prewitt's filter.

• The watershed algorithm may also be run fully automatically, for example, by using local minima from a variance filter as seed points.

• One split-and-merge algorithm finds a partition of an image such that the variance in pixel values within every segment is below a specified threshold, but no two adjacent segments can be amalgamated without violating the threshold.

The results from automatic segmentation can be improved by:

• using methods of mathematical morphology.

• using domain-specific knowledge,

The segmentation results will be used to extract quantitative information from images.

APPLICATIONS:

- Content-based image retrieval
  - Machine vision
  - Medical imaging, including volume rendered images from computed tomography and magnetic resonance imaging.
  - Locate tumors and other pathologies
  - Measure tissue volumes
  - Diagnosis, study of anatomical structure
  - Surgery planning
  - Virtual surgery simulation
  - Intra-surgery navigation
- Object detection
  - Pedestrian detection
  - Face detection
  - Brake light detection
  - Locate objects in satellite images (roads, forests, crops, etc.)
- Recognition Tasks
  - Face recognition
  - Fingerprint recognition
  - Iris recognition
- Traffic control systems
- Video surveillance
- Video Object Co-segmentation and action localization.

~K.SiriVarsha (1761A0417)


BLOCK-IV
ELECTRONICS & COMMUNICATION ENGG.
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