Holistic Approach in Deep Learning and its Applications

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Abstract. Deep learning has become a territory fundamental to scientists in the past barely any years. Convolutional Neural Organization is a significant learning approach that is thoroughly utilized for managing complex issues. It beats the prerequisites of standard Artificial Insight moves close. Critical learning, a technique with its establishment in fake neural systems, is making beginning late as a remarkable asset for computer based intelligence, promising to reshape the conceivable predetermination of man-made reasoning. Getting data and important encounters from unusual, high-dimensional and heterogeneous biomedical data remains a key test in changing clinical administrations. Moreover we will investigate the difficulties in enormous information assessment.

keywords:- Deep Learning, Artificial Intelligence, Big data analytics, Convolutional neural network, neural network.

1. Introduction

Signal handling research these days has an altogether extended degree contrasted and only a couple of years back. It has included numerous expansive territories of data handling from low-level signs to more significant level, human-driven semantic data. Since 2006, profound organized learning, or all the more generally called profound learning or progressive learning, has risen as another zone of AI research [1]. Inside the previous hardly any years, the strategies created from profound learning research have just been affecting a wide scope of sign and data preparing work inside the conventional and the new, augmented extensions including AI and computerized reasoning. Profound Learning today outperforms different Machine Learning approaches in execution and is generally utilized for a wide range of assignments. Profound Learning has expanded precision contrasted with different methodologies for undertakings like Language Translation and Image Recognition. However, this didn't/couldn't occur over a couple of years, took decades!

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Profound learning utilizes counterfeit neural systems that got motivation from the neuron present in the human mind. It comprises layers, and the word profound alludes to the profundity of layers [2]. At first, the word profound alluded to not many layers, yet because of the utilization of profound learning in complex issues, the quantity of layers is in hundreds and even thousands. Significant learning is fruitful in numerous spaces, for example, picture preparing, medical services, transportation, and farming; with the assistance of profound learning, increasingly more information can be used in most ideal and it is getting notoriety because of the accessibility of prepared dataset, for example, ImageNet that contains a large number of pictures [3]. Furthermore, the ease GPUs are in more use to prepare information and can profit the administrations of cloud also. Monster organizations are utilizing profound learning strategies to break down the colossal measure of information on a regular schedule. Profound learning got high consideration from analysts as well as from techno organizations too. Web-based media organizations create a huge volume of information on an everyday schedule because of the quantity of clients they have. It is significant for them to deal with this immense information regularly named as "Large Data." By utilizing conventional information investigation instruments, it is troublesome and practically difficult to have a decent understanding of the information and concentrate the important information from it. The different leveled getting the hang of designing of Profound Learning figuring’s is energized by man-made mental aptitude mirroring the significant, layered learning pattern of the basic sensorial regions of the neocortex in the human cerebrum, which hence takes out highlights and discussions from the covered information.

2. Literature Review

The allure of using neural frameworks could be a direct result of its non-linearity in the framework. Therefore, the component extraction step may be more successful than the straight Karhunen-Loève techniques [4]. One of the essential fake neural frameworks (ANN) techniques used for face affirmation is a single layer adaptable framework called WISARD which contains an alternate framework for each set aside individual. The way in building a neural framework structure is basic for successful affirmation. It is a ton of subject to the arranged application. For face area, multilayer perceptron and convolutional neural framework have been applied.

In 2006, a two-phase methodology was proposed for preparing profound learning viably. This was the initial step to expand enthusiasm for DL. In 2012, Krizhevsky et al. gained a remarkable ground by improving the Main 5 misstep rate from 26.2% to 15.3% in the ImageNet competition which is the most significant contention in the article affirmation field. This achievement accomplished extraordinary responses in the institute, and expanded enthusiasm for DL [5]. Other than the scholastic networks, numerous innovation organizations additionally add to the advancement of DL approaches by supporting.

DL calculations for the most part comprise of two stages: locale proposition and area arrangement. Shi et al. proposed a Fast Recurrent-CNN to distinguish vehicles [6]. They tried the calculation on the open KITTI informational index, self-gathered BUU-T2Y informational index, and blended informational index. In another investigation, Du et al. proposed a DL structure for vehicle location, which wires LIDAR and camera. Soin and Chahande proposed moving vehicles recognition on-street for driverless vehicle help frameworks dependent on R-CNN. They guaranteed that the technique was accomplished
100% precision as for location exactness on the CIFAR-10 dataset. Impediment identification and arrangement on-street is one of the key undertakings in the discernment arrangement of self-driving vehicles.

RNN and CNN have a consistent increment in application throughout the long term, with CNN displaying a gigantic development rate. This can be credited to the achievement recorded in picture information and the numerous accessible variations of the model. Positron emanation tomography and CT examine picture handling are at the front line of numerous medical care applications. CNN has given the required preparing methods needed to accomplish anticipated execution. The development rate in the use of this strategy is relied upon to proceed as more biomedical picture applications will change to this method [7].

Character insistence is as of not long ago one of the most testing fields for scientists. Particularly, the truly created character attestation is a weakening undertaking since the character as a rule has different appearances as per an author, making style and whine. Penmanship confirmation is made out of two sorts such on the web (stroke heading based) and withdrew (picture-based). Because of the lacking number of highlights that portray, the confined penmanship character insistence issue is more badly designed than on the web. With the amazing movements on the DL, different experts attempt to manage this issue by utilizing DL based methodology. One of the imperative DL-set up evaluations with respect to penmanship character certification is translated digit attestation appropriated by Y. LeCun et al. They proposed a completely related multilayer neural affiliation called LeNet for deciphered digit insistence [8].

The most essential constraint of Run of the mill language processing research on Noteworthy learning is inadequate with regards to information. Hence, Galinsky et al. proposed information increase progresses toward supplanting words with their partners, reshuffling the words and including new descriptors. After augmentation, they utilized CNN for keeping an eye out for the tendency assessment issue on Russian language. Ordinary Language Age structures have not been summed up across domains, and this is truly confining their accommodation past a solitary application [9].

3. Neural Networks

The brain of a human being has an incredibly significant building. For Example the visual cortex of the cerebrum shows a progression of zones which contain an address and input and a sign that streams beginning with one then onto the following. Individuals create their contemplations logically. For quite a while, Mankind has endeavored to rehash the handiness of the cerebrum as a mathematical model. Demonstrating a PC to behave like a human in various circumstances. This inspiration delivered counterfeit neural frameworks [10].

A neural framework is an advancement of computations that attempts to see pressing connections in an immense measure of data through a cycle that emulates the way wherein the human brain works. In this sense, neural frameworks suggest structures of neurons, either ordinary or phony in nature. Neural structures can acclimate to making data; so the framework makes the best result without needing to strengthen the yield norms.
Supervised and Unsupervised learning

Controlled learning as the name exhibits the presence of a boss as an educator. Fundamentally administered learning is a learning wherein we instruct or train the machine utilizing information which is by and large named that induces some information that is beginning to now set apart with the right answer. Beginning now and for a significant length of time, the machine is given another blueprint of examples(data) so organized picking up figuring assessments the arranging data(set of preparing models) and passes on a right result from named information.

Solo learning is the game plan of a machine utilizing data that is neither masterminded nor checked and permitting the figuring to get up to speed with that data without course. Here the undertaking of the machine is to package unsorted data as per similarities, models and separations with no earlier preparation of information. As opposed to oversaw learning, no educator is given that recommends no preparation will be given to the machine. Thus machines are kept to locate the shrouded structure in unlabeled information by our-self.
4. Deep learning in health informatics

The enthusiasm for Artificial Intelligence in the field of prosperity informatics is moreover growing and we can plan to see the potential preferences of man-made mental aptitude applications in clinical administrations. Significant learning can help clinicians with diagnosing infection, recognize threat objections, perceive drug impacts for each patient, appreciate the association among genotypes and phenotypes, research new phenotypes, and anticipate powerful ailment flare-ups with high exactness. Rather than standard models, its philosophy needn't bother with region unequivocal data pre-cycle, and it is ordinary that it will in the end change human life a ton later on. Despite its striking inclinations, there are a couple of challenges on data (high dimensionality, heterogeneity, time dependence, inconsistency, nonappearance of name) and model (trustworthiness, interpretability, attainability, flexibility) for useful use.

Success informatics and how critical learning can be utilized in thriving informatics can be clarified with clinical informatics and choice assistance. Utilizing information variety and assessment from different information sources, specialists train models to recognize what clinicians do when they see the patients and let them produce strong clinical data. It joins how to investigate clinical pictures, anticipate results, find the relationship among genotype and phenotype or phenotype and affliction, review treatment reaction, track a sore or aide change (ex. decreased hippocampal volume). Imagining results (ex. sickness) or readmissions can be contacted an early notice framework with danger scoring. Recognizing connections and models can be loosened up to overall model investigation and people clinical consideration, for instance, giving judicious treatment to the entire people. Significant learning in prosperity informatics has various great conditions that it will in general be set up without from the prior, which fights the nonappearance of named data and weight on clinicians [11]. For example, clinical imaging oversaw data complexity, secured disclosure target centers and 3-or 4-dimensional clinical pictures. Examiners outfitted more current and elaborative outcomes with data extension, un-/semi-managed learning, move learning, and multi-procedure models.
Figure 4. Appropriation of distributed papers that utilization profound learning in subareas of wellbeing informatics.

Figure 5. Level of most utilized profound learning techniques in wellbeing informatics. (DNN: Profound Neural Organization, CNN: Convolutional Neural Organization, RNN: Intermittent Neural Organization, AE: Autoencoder, RBM: Confined Boltzmann Machine, DBN: Profound Conviction Organization)
5. Challenges in Enormous Information Assessment

Large Information for the most part intimates information that beats the standard putting away, preparing, and figuring cutoff of ordinary enlightening assortments and information appraisal frameworks. As an advantage, Huge Information requires gadgets and methodologies that can be applied to dismantle and disengage models from an enormous degree of information. The ascending of Large Information has been accomplished by expanded information storing up limits, broadened computational arranging power, and availability of extended volumes of data, which give partnership more data than they have figuring resources and advances to quantify [12]. Regardless of the verifiable stunning volumes of information, Huge Information is in like way connected with other unequivocal complexities, sometimes suggested as the four Versus: Volume, Assortment, Speed, and Veracity. We note that the reason for this zone isn't to by and large cover Enormous Information, yet present a short outline of its key considerations and difficulties.

Various systems have been proposed to utilize simulated intelligence for massive datasets close to Hadoop and MapReduce models. Fundamentally, the on the web and noteworthy learning is moreover gotten a handle on close to computer based intelligence to defeat the difficulties of huge information. Summing up the difficulties present with enormous information utilizing machines and noteworthy learning, we run over unstructured information obtained from heterogeneous sources, high and energetic streaming information, tumultuous and terrible quality information, high-dimensional information, and information with limited names. Before applying AI systems to gigantic data examination, one can have enough data on quantifiable techniques and sign taking care of strategies. The sign dealing with strategies expect a critical part in portraying data procured from heterogeneous sources and data sources gave a work recognizing signal getting ready techniques to address various challenges, for instance, tremendous extension, particular data types, quick data, divided and questionable data, and thickness of data. In this way, compelling systems are relied upon to vanquish the issues of high memory necessities. Significant Learning counts are one promising street of examination concerning the robotized extraction of complex data depictions at critical degrees of reflection. Such computations develop a layered, dynamic structure of learning and addressing data, where more huge level features are described with respect to bring down level features. The different leveled picking up designing of profound Learning computations is impelled by man-made thinking replicating the significant, layered learning pattern of the basic sensorial areas of the neocortex in the human cerebrum, which therefore isolates features and considerations from the concealed data. Significant Learning figuring’s are beneficial when overseeing picking up from a ton of solo data, and normally learn data depictions in a greedy layer-wise style. Colossal Data addresses the general space of issues and systems used for application spaces that assemble and keep up enormous volumes of rough data for region unequivocal data examination. Advancement based associations have assembled and kept up data that is assessed in exabyte degrees or greater. Additionally, online media relationships have billions of customers that consistently make an uncommonly gigantic measure of data. Different affiliations have set resources into making things utilizing Huge Information Investigation to look out for their watching, experimentation, information assessment, augmentations, and other information and business needs, making it a focal subject in information science research.

6. Role in Image Classification

Classification is a methodical course of action in gatherings and classes dependent on its highlights. Picture arrangement appeared for diminishing the hole between the pc vision and human vision via preparing the computer with the information. The picture characterization is accomplished by separating the picture into the recommended classification dependent on the substance of the vision. The customary strategies used for picture gathering is part and piece of the field of man-made cognizance (simulated intelligence) formally called as computer based intelligence. The man-made intelligence contains a
extraction module that eliminates the huge features, for instance, edges, surfaces, etc. and a gathering module that portrays subject to the features removed [13]. The essential limitation of computer based intelligence is, while detaching, it can simply focus a certain game plan of features on pictures and unable to isolate features from the planning set of data. This bother is changed by using significant learning. Profound learning is a sub field to artificial intelligence, fit for learning through its own strategy for figuring. The plan of an ANN is reproduced with the help of the natural neural arrangement of the human cerebrum. This makes the significant adapting commonly fit more than the standard artificial intelligence models. In significant learning, we consider the neural frameworks that perceive the image reliant on its features. This is polished for the structure of an absolute part extraction model which is prepared for disentangling the difficulties looked at as a result of the customary methods.

6.1 Convolutional Neural Network

The idea of picture request and article recognizable proof has been radically improved due to the significant learning procedure. Convolutional neural frameworks procured a change in the PC vision area. It not simply have been steadily moving the image request exactness, yet furthermore accept a noteworthy part for customary segment extraction, for instance, scene course of action, object acknowledgment, semantic division, picture recuperation, and picture engraving [14].

Convolutional neural framework is one of the most great classes of significant neural frameworks in picture dealing with tasks. It is uncommonly ground-breaking and normally used in PC vision applications. The structure of CNN contains Convolutional, pooling, Amended Straight Unit, and Completely Associated layers.

Figure 6. convolutional neural frameworks design

A. Convolutional Layer: Convolutional layer occurs inside the structure square of a Convolutional Affiliation that does by a wide edge an immense aspect of the computational truly bothering work. The crucial piece of the Convolution layer is to isolate highlights from the information which is a picture. Convolution guarantees the spatial association between pixels by learning picture highlights utilizing little squares of information. The information picture is tangled by utilizing a gigantic proportion of learnable neurons.
B. Pooling Layer: Pooling layer reduces the dimensionality of each incitation map anyway continues having the most critical information. The data pictures are confined into a ton of non-covering square shapes. Each district is down-tried by a non-straight action, for instance, ordinary or generally extraordinary.

C. Amended straight unit Layer: It is a non-straight development and merges units utilizing the rectifier. So as to see how the ReLU capacities, we recognize that there is a neuron input given as x and from that the rectifier is depicted as \( f(x) = \max(0, x) \) in the synthesis for neural systems.

D. Completely associated layer: It alludes to that each channel in the past layer is associated with each channel in the following layer. The yield from the convolutional, pooling, and ReLU layers are epitomes of significant level highlights of the information picture. The objective of utilizing the CAL is to utilize these highlights for ordering the information picture into different classes dependent on the preparation dataset. CAL is viewed as the last pooling layer taking care of the highlights to a classifier that utilizes SoftMax actuation work.

6.2. Zones where it utilized

Profund learning has been applied in various fields, such as PC vision, signal preparing, and discourse acknowledgment.

6.2.1. Visual perception

As we probably am aware, convolutional neural frameworks are useful assets for picture acknowledgment and grouping. Various sorts of CNNs are frequently tried on notable ImageNet Large Scale Visual acknowledgment Challenge dataset and accomplished best in class execution as of late [15]. It has been applied with unprecedented achievement to the article recognizable proof, object division, and affirmation of things and locale in pictures. Differentiated and hand-made features, for example, Local Binary Patterns (LBP) and Scale Invariant Feature Transform (SIFT), which need additional classifiers to handle vision issues, the CNNs can pick up capability with the features and the classifiers together and give unrivaled execution.

6.2.2 Face affirmation

Face affirmation has been one of the most huge computer vision endeavors since the 1970s. Face affirmation systems normally include four phases. At first, given a data picture within any event one faces, a face finder finds and detaches faces. By then, each face is pre-dealt with and balanced using either 2D or 3D showing procedures. Next, a component extractor removes features from a balanced face to secure a low-dimensional depiction (or embedding) [16]. Finally, a classifier makes estimates subject to the low-dimensional depiction. The best approach to getting extraordinary shows for face affirmation structures is procuring an effective low-dimensional depiction.

Face affirmation systems using hand-made features consolidate. Lawrence first proposed using CNNs for face affirmation. Starting at now, the top tier execution of face affirmation structures, that is, Facebook's Deep Face and Google's FaceNet, rely upon CNNs.

6.2.3 Experiment

A Picture course of action on designed data

In this, we considered a model subject to a designed enlightening assortment which is worked by 4 kinds of computation parts: triangle, square, circle, gem. The size of all designed pictures
are 60 x 60 with dull establishment (power regard 0). The major figuring parts are made inside
a hopping box 20 x 20 and self-assertive power regards in [1; 255]. These parts are then resized
with sporadic scales up to 10% in stature and width, and self-assertively arranged on the image
establishment. In building the two picture classes, they ensure that the triangle and square are
the "specific" segment and simply appear in Class1 and Class2, independently. Other than the
specific part, each image has another segment, which is indiscriminately investigated as a circle
or gem by coin flipping. As a rule, they make 2000 planning, 2000 endorsement and 2000 for
testing tests (1000 for each class). Let TP (authentic positive) imply the amount of tests having
a spot with class k and adequately assembled; FN (fake negative) mean the amount of tests
having a spot with class k anyway misclassified; FP (false sure) show the amount of tests not
having a spot with class k yet misclassified as class k. Request exactnesses are represented
similar to audit, precision and F1 score as

\[
\text{Recall} = \frac{TP}{TP + FN}; \quad \text{precession} = \frac{TP}{TP + FP};
\]

\[
\text{F1 Score} = 2 \left( \frac{\text{precession} \cdot \text{recall}}{\text{precession} + \text{recall}} \right)
\]

The request precision of the standard CNN computation is 83.3%, as shown in the "SCNN"
section in Table I(a). This shoddy execution results from the way that the overall CNN learning
plan may not get acquainted with the most discriminative close by fixes. Regardless of what
may be normal, the most discriminative and non-helpful neighborhood patches are feasibly
found by the two-stage learning structure. The discovered model exactly organizes the norm of
making these two classes. By using these close-by fixes, request precision can show up at 100%
("BCNN2" line in Table I(a)).

An evaluation study is composed utilizing: (1) decided fall away from the faith (LR); (2) SVM;
(3) standard CNN, as LeNet [], organized on entire picture (SCNN); (4) near to fix based CNN
without assistance, i.e., the CNN masterminded by pre-train stage just (PCNN); (5)
neighborhood fix based CNN helped without extra non-enlightening class (BCNN1); (6) near
to fix based CNN helped with both discriminative and non-important patches (BCNN2).
Procedures (1)– (3) address standard getting (utilizing picture controls obviously as highlights)
and noteworthy learning moves close. Methodologies (4), (5) are two assortments of our
proposed one (6), which are familiar with checking the impacts of all parts of our procedure
[17]. The constraints of LR and SVM are upgraded utilizing framework search with cross-
derunderwriting. All CNN related frameworks utilize a tantamount moderate arrangement: one
convolutional layer with 10 5 channels, one max-pooling layer with 2 x 2 digit, one secured
layer of 300 focus, at last followed by a LR layer to yield reaction. The fix size for all fix based
CNNs is 3030. There are 36 patches taken out from every 60 x 60 picture through a sliding
window with 6-pixel step size.

As shown in Table I(a), the standard vital learning structure (SCNN) is bett
er than LR, which
shows basic taking in can take in exceptional features from terrible data. By using the close by
discriminative information, PCNN gets 16% improvement from SCNN. Among the local fix
based CNNs (PCNN, BCNN1 and BCNN2), BCNN1, which is set up on discarded
discriminative (without non-obliging) patches, is more shocking than PCNN due to overfitting.
BCNN2, which sets each organized part, achieves the best show.

To besides show the adaptivity of the figuring, they relabeled the planned information utilizing
Significant stone and buoy as explicit parts in class 1 and class 2, autonomously (see Fig 7a).
Close to the day's end, despite how the planned information is actually indistinguishable, the
nearby fixes to see the two classes become uncommon. This is in relationship to certified issues
where the datasets are indistinguishable yet the depiction objective is changed. Following to
driving the pre-train figuring, the eliminated neighborhood patches from the educated model are
appeared in Fig. 7b. Once more, The eliminated close by fixes contain the most discriminative
data, important stone and circle. The social event exactnesses are appeared in Table II(b). Once
more, the two-stage learning structure BCNN2 accomplishes the best presentation among all
relationship frameworks. This outcome shows that the multi occasion CNN learning can
adaptively learn discriminative neighborhood areas for express solicitation undertakings with
no near to level comments.

Figure 7 (a) synthetic images of two classes recognized by diamond and circle. (b) The
discriminative and non-informative local patches found by the pre-prepared CNN model.

Table 1. Classification accuracies on synthetic data in terms of recall, precision and F1
score(%).
Table 2. Classification accuracies on synthetic data in terms of recall, precision and F1 score(%).

| Class     | Recall | Precision | F1    |
|-----------|--------|-----------|-------|
|           | 1      | 2 | Total  | 1      | 2 | Total  | 1      | 2 | Total  |
| LR        | 70.3   | 62.5 | 64.4   | 65.2   | 67.8 | 66.5   | 67.7   | 65.0 | 66.5   |
| SVM       | 69.0   | 63.1 | 61.1   | 65.2   | 67.1 | 66.1   | 67.0   | 65.0 | 66.1   |
| SCNN      | 91.8   | 94.2 | 92.4   | 94.1   | 92.0 | 93.0   | 92.9   | 93.1 | 93.0   |
| PCNN      | 99.6   | 100  | 99.8   | 100    | 99.6 | 99.8   | 99.8   | 99.8 | 99.8   |
| BCNN1     | 95.6   | 100  | 97.8   | 100    | 95.8 | 97.9   | 97.8   | 97.9 | 97.9   |
| BCNN2     | 99.9   | 99.9 | 99.9   | 99.9   | 99.9 | 99.9   | 99.9   | 99.9 | 99.9   |

7. Conclusion

The purpose behind the notoriety of profound learning is the huge increment in the information that is utilized for preparing and the advances in AI and data handling. In this paper we have examined with respect to different ideas of profound learning. In spite of the fact that the utilizations of profound learning are still in its early state, it shows promising extension in the field of picture, video and discourse acknowledgment. Additionally, Big Data multifaceted nature and assortment are featured in this paper. It is contended that traditional advances and calculations can't separate examples from dataset because of less number of highlights. Profound learning is effectively investigated by information researchers because of its high precision with less component designing. Progressive deliberation layers can extricate data even from complex dataset. In this paper, numerous methods for Big Data investigation utilizing profound learning are looked into. This makes it a significant instrument for enormous information assessment, which includes information examination from exceptionally huge assortments of crude information that is commonly unaided and un-classified. We have sketched out how profound learning has empowered the advancement of more information driven arrangements in wellbeing informatics by permitting programmed age of highlights that decrease the measure of human mediation in this cycle. This is worthwhile for some issues in wellbeing informatics and has inevitably upheld an incredible jump forward for unstructured information, for example, those emerging from clinical imaging, clinical informatics, and bioinformatics. Up to this point, most uses of profound figuring out how to wellbeing informatics have included handling wellbeing information as an unstructured source.

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