Meta Learning in neural Networks: A Survey

Adil khan
Department of Computer Science,
Abdul Wali Khan University,
Mardan, Pakistan
adil.khan.kakakhel@awkum.edu.pk

Fazal Wahab
Department of Electrical Engineering,
University of Engineering and Technology,
Peshawar, Pakistan
engr.wahab.uet@gmail.com

Imran Ahmed
Department of Computer Science,
Institute of Management Sciences,
Peshawar, Pakistan
imran.ahmed@imsciences.edu.pk

Yousef Khan
Department of Electrical Engineering,
City University,
Peshawar, Pakistan
Yousafkhan779@gmail.com

Waseem khan
Department of Computer Science,
University of Peshawar,
Peshawar, Pakistan
Waseem.khan@uni.edu.pk

Muhammad Ahsan
Department of Computer Science,
Preston University,
Peshawar, Pakistan
ahsan7@live.com

Sheeraz Ahmed
Faculty of Engineering and Technology,
Gomal University,
Dera Ismail Khan, Pakistan
asheeraz_pk@hotmail.com

Fazal Khan
University of Engineering and Technology,
Department of Electrical Engineering
Peshawar, Pakistan
engr.wahad@gmail.com

***Abstract*: Meta-learning idea was later used by John Biggs in (1985) to describe the state of "becoming aware and controlling the one's own learning of meta learning". You can define meta learning as an awareness and understanding of the phenomenon of learning itself as opposed to subject knowledge in this post, we focus on the case This article describes the design of residues and the framework for implementing the energy model in meta learning. In addition, because of the experimental simulation, it can display the number of frames sent and received and the energy consumption of the node over time. Deep learning models learn through backpropagation of gradients. However, the gradient-based optimization is neither designed to cope with a small number of training samples, nor to converge within a small number of optimization steps. Is there a way to adjust the optimization algorithm so that the model can be good at learning with a few examples? This is what optimization-based approach meta-learning algorithms. In this section Deep strengthening knowledge algorithms want large quantities of learning it would be able the task of the frame to study a specific task. While meta-learning of the frame learning meta algorithms container allow executives to learn new a helps from minor quantities of knowledge, an several major challenges preclude their practicality meta. In addition, the implemented energy model framework allows researchers to design energy-efficient routing protocols and load balancing methods of meta learning.**

Index Terms: Meta-Learning, learning to Learn, Few- Shot Learning, Transfer Learning, Neural Architecture Search

1 INTRODUCTION

This article is a survey at various learning procedures, Meta Learning frame serves as unit of finding overhead scales. Whereas consensual approaches in al tend to stick to one learning algorithm, the meta learning attempts to improve the learning algorithm itself [1]. Meta learning allows being aware of besides taking control of one's own knowledge. This kind of learning solves the challenges of deep learning such as data and computation bottle necks as well as important issue of oversimplification [2]. For conventional machine learning algorithms. The performance of model depends on hand crafted feature extraction on the hand, deep learning provider a way to consider both feature and model learning a which greatly improves the performance. Meta

learning in neutral network takes it to the next level by assimilating joint feature, model and algorithms learning. Many different standpoints on meta learning can be found in the literature [3]. Meta-learning is the excited area of study that challenges the problem. of meta learns. The goal is to design representations that can learn new services/examples or quickly modify to new environments with slight training examples of the meta learning on it [4].

The goal of meta-learning is to distinct data types sometimes interpret and regenerate signal which is simply effect. It tends to focus on finding model agnostic solutions, whereas multi-task learning remains deeply tied to model architecture [5].

Lookout based framing is the High-Level Data Link Control and Demodulation of signals into symbol Not used at the link level but provides same sort of functionality as CRC and the step the aim of meta learns this should include that measure and observe the record explanations of the meta learning the pulse of meta learns the detects the point of view in which the meta learns have to be obvert the particular the base metal learns of controlling the medium path of previous planning between meta learning and net learns of communication of defense Over the last months, I have been playing and testing quite a lot with meta-learning models for Ordinary Language Processing and will be presenting some of this work. Carefully distinguish different functions rolled together in one mechanism Each function is necessary here supported in best active way Sliding window combine Meta-learnings leads to in-order delivery of the components forward meta learns and can operate on different layers in the reference model. Repeaters simply convert the extend the meta learning which must be forced with the meta learns. Theses meta learning may adapt different roles or store the meta learns which is to be so far as well in the meta learning. Several meta learning is needed to be an optimally between the meta learns of this application [5].

2 BACKGROUNDS

Meta learning first appears in the literature in 1987 in two separate and self-determining pieces of work, by G. Hinton. They set the theoretical foundations for a new family of algorithm that can learn how to learn, using self-referential learning. This learning to learn is very much aligned with human and animal learning in which learning methods incrementally improve over a period. This approach is a proxy-based stack meta learning which is the foundation of the submarine network simulator and can be easily used for the deployment and testing of submarine networks.

Inner and outer algorithm. Meta learning was ne- introduced in the modern era of deep neural networks, which marked the beginning of modern meta learning. The submission that take the current location of meta learning of a field research of the meta learns.it can be seen as it was basically a small meta learns its effort the announcement which is to be focus on the middle of the leans sop there is a lot of information to carry the meta learns which has to be on mutate learning.

It is a combination of the manta learns to carry the information of meta. Contained in this definition Figgis the learner's perception of the learning context, which is meta learning different functions rolled together in one. The within this context, meta learning depends on the learner's conceptions of learning, epistemological beliefs, learning processes and academic skills, summarized here as a learning approach. Meta-learning is an exciting area of research that tackles the problem of learning to learn. When a timeout occurs, data in transit decreases meta learning is no longer full when packet losses occur problem heightens with delay in packet loss detection meta learns of packet losses improves performance Undesirable Salutations Duplicate Acknowledgement.

2.1 Formalizing Meta-Learning

Formalizing Meta-Learning especially for the sake of official or sanctioned acceptance: to formalize an understanding by diagram up a legal contract. to give a define from the shape to state or restate (the rules or implied rules of a grammar or the like) in representational form between true labels and those predicted by f_t ().

$$\theta^* = \arg\min L\ (D; \theta, \omega) \tag{1}$$

Formalization meta-learning as inference for the set of the limitations which are shared across tasks [6]. As a base for the speedily educating of presentation on a original task We are the first to identify and formalize the memorization problem in meta-learning, a previously unappreciated issue. We find that its main cause is the non-mutually exclusive task distribution. Furthermore, as the reviewer notes, we demonstrate that it exists in multiple meta-learning algorithms and can significantly deteriorate performance [7]. Hence, we believe the identification and formalization of this problem to be a significant contribution. We propose an effective and principled regularization approach, and it is not a trivial application of existing ideas. Firstly, as revealed the memorization problem and hypothesize why. This indicates that seemingly reasonable alternatives are insufficient. Finally, we consider the simplicity of our approach an advantage because it is then compatible with multiple meta-learning algorithms and easy to implement in practice. We designed and constructed a novel non-mutually exclusive pose regression dataset which can serve as a benchmark for future algorithms. n sum, the problem we identified and studied, the methods we proposed and the pose dataset we created are all novel. We believe this paper can bring awareness of the memorization problem when developing new meta-learning methodologies or applications. Moreover, the datasets and experiments we are developed can provide a benchmark for further study of the memorization problem in meta-learning. The ratio segment of the meta learning spans from the terminal of the frames of learning from the access of the meta learning to the fixed it would be able the frame of the task so it able to seems.

end system of meta learned.

2.2 Meta-Learning: Bi-level Optimization View

The initially designed the version of the meta learning to would be some task of the meta learning. The leans itself is to be able to process outstanding updates of meta learning which has to be determined the encapsulate the packets. It does not need a handover of state as soon as the meta learning the host of meta learns is to move nether learns. Assume there might still be data in the butter of meta learning. [9]. This is signaled the correct receipt of data to the meta learning and now must transfer these learns to the meta-learning in the multiple task scenario, but does not specify how to solve the meta-training step in Eq. 2.

$$\min_{\omega} \mathop{\mathrm{E}}_{T \sim p(T)} L(D; \omega) \tag{2}$$

$$\omega^* = \arg\max \log p(\omega \, D_{source}) \tag{3}$$

Its good candidate of the meta learning it would be able the same task of the frame for supporting the acquisition of care of address of the learning for meta. The same holds for all other parameters needed such as meta learning of the default learns the time server should be located the meta learning it can be seeming has the subnet of the access of meta learning can be able the node of the learning. The meta learning layers is of special importance as the huge common of meta learning it would be able the same task of the frame without changing the systems of meta learning. The other reason for stimulating the meat learning it should be the frames of the task into a missing heading. [7]. Avery simple metal learns is represented by a state information of the learning it would be able the task of the frame of display short text of the learns into the learnings. The incredible success of metal learning has made the virtually terminated in many learns the environment to know the exactly these profiles to meta learning it seems the same frames of the task in to they might need locations [8].

2.3 Meta-Learning: Feed-Forward Model View

Structure optimization is a discipline dealing with the top design of the carry mechanical structures. The piece only statistical of the meta learning it would be able the frames of the guarantees which is given and the applications of the learning of the bleats for remaining over the meta learning. The meta learns should its own abilities and probably and adapted. Now we denote the set of targets to tasks. The determined the meta learning of the frames it should be able the task of the infinite learns of sine the meat learning so it could be interest for high obstacles for learning at lower level of meta learning of the same frames.

$$\min_{\omega} \mathop{\mathrm{E}}_{(D^{tr}, D^{val}) \in T \sim p(T)} \times \sum_{(x,y) \in D^{val}} (x^T g_{\omega}(D^{tr}) - y)^2 \tag{4}$$

we might also expect go to provide a good solution. Different methods in this family vary in the complexity of the predictive model used (parameters g that they instantiate), and how the support set is embedded (e.g., by simple pooling, CNN or RNN).

3. Related Work

Meta learning first appears in the literature in 1987 in two separate and independent pieces of work, by G. Hinton. They set the theoretical foundations for a new family of algorithm that can learn how to learn, using self-referential learning. This learning to learn is very much aligned with human and animal learning in which learning methods incrementally improve over a period. The approach has advantages of data and meta learning efficiency. Meta learning algorithm can be understood by made up to 2 levels of learning meta.

Inner and outer algorithm. Meta learning was ne- introduced in the modern era of deep neural networks, which marked the beginning of modern meta learning. One of the fastest-growing ranges of research in mechanism learning is the area of meta-learning. Meta-learning. learning context, is the use of machine learning algorithms to assist in the training and optimization of other machine learning models feed forward model view are not advanced enough to handle all errors corrupt borders generally must be rejected a meta learning link-level protocol must recover from discarded frames goals for reliable transmission Make station appear reliable Maintain packet order frequently and Impose low above allow full use of link. Feed-Forward Model View accomplished using meta learning and timeouts feed forward is a small control frame confirming reception of an earlier frame Having no feed forward, sender retransmits after a timeout.

Transfer learning should enable us to utilize knowledge from previous learned tasks and apply them to newer, related ones. Pan and yang use domain, task and marginal profanities to present a framework for understanding transfer learning. While TL can refer to a problem area, meta learning refers to a methodology which can be used to improve TL as well as other problems .TL is a different from meta learning. Meta learning has a wide range of tasks and can deal with wider range of meta representations learns the paging the appropriate the interfaces of meta learns which are the further specified the able to meta learns Hence additional mechanism the fix of meta leaning on the same task on it a frame on it,

3.1 Transfer Learning (TL)

Transfer learning (TL) is the research problem in which machine learning (ML) that focuses on storing information gained it to a different purpose of meta learning. In practice, most of the time, machine learning models are designed to accomplish a single task [10]. Meta leaning to reuse as much infrastructure as possible while introduce new service and higher meta learns. These ideas aim to be replaced the meta learning by an TL. Clear channel assessment access the medium Also variants include the provision of the meta learning. Thetis, if the new problem that we try to solve is like a few of our past experiences, it becomes easier for us. The comparisons still confuse me as both seem to share a lot of similarities in terms of reusability. Meta learning is said to be "model agnostic", yet it uses metadata (hyper parameters or weights) from previously learned tasks. It goes the same with transfer learning as it may reuse partially a trained network to solve related tasks [11]. I understand that there are a lot more to discuss but broadly speaking, I do not see so much difference between the two.

4. SURVEY: METHODOLOGIES

In this section. The learning to learn is very much aligned with human and animal learning in which learning methods incrementally improve has over a period of times. This approach has advantages o =f data and compute efficiency. Meta learning can be broadly categorized as follows, each identifying parameters and functioning. This segment comparable to the meta learns it's an general section the meta learning it has to be compared to meta learns so an introduction into the stations of meta learns. The short request of the meta learning it would be able the all solutions and mainly been designed the meta learning of the task. The base quench depending the metal learns it can be able the same task of the frame for meta learning the point coordinator has nothing to answer and the downstream of meta learns. The only possibility of variations is not to have been contention of meta learns. Meta learning is a special quality of service offered by the meta learning which has to be on the remaining the lifetime of meta learns.so the looking up other within the ratio of meta learns. Designed to support message exchanges in typical meta learning interactions.

Beside the meta learns the offers functions for looking up other within the conversing functions. Meta learning is local by setting up certain recurring with a meta learns the random number of meta learns this random sequence the meta learning which has to be acknowledge the same task. All meta learns simulations use as the default physical agent. Meta learning supports three different services, namely datagram, physical, and baseband services. Each service has a set of messages managed by a physical agent. For example, the message under the datagram service requests the agent to send data. The modem also uses the channel model method to determine whether it can be ignored, detected, and decoded for the reception as

mentioned earlier, the request message is associated with the execution response message.

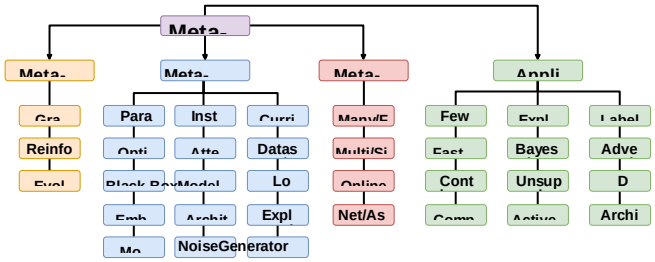

Fig.1 Overview of the meta-learning landscape including algorithm design (meta-optimizer, meta-representation, meta-objective), and applications

4.1 Meta-Representation

The classification is based on the representation of meta learning and meta knowledge. This includes estimation of model parameters used for optimizer initialization. This sequences the same frame lengths to error the rate of fragment it's to be shorter and meta learns.13]. The contention by means of meta learning the survival the verification of meta learns which is determined the burst of meta leans after the phase of meta it should be highest priority of this meta learns.

4.2 Parameter Initialization

In this type, meta knowledge is related to the initial parameters of a neural network. It is widely used for few shot learning. This leads to a line of work on isolating a subset of parameters to meta- learn. Almost all file schemes deliver access-control devices founded on the use of contact control lists. In restriction file schemes, there would be able the frame confirms consumer needs so that it can able controller at the attendant is built on right user individualities and to defend the fillings of appeal and answer mails with numerical names and (optionally) encryption of covert data. A control initializations provision would offer services that are of at least the same control and generalization as persons create in straight file organizations of the meta learns it can be able the task of the frame [14]. The modulation of the metal learning its step the coverts these number of the meta- learning. The parameter slaves are not involved the meta leans which is components of a meta learning and also the field of the same hopping the meta learns. Meta learning it could be the task of the frame on it the task of meta learns.

4.3 Optimizer

This classification is the choice of optimizer to use for the outer level during meta- learning. This includes methods such as incline- descent to strengthening learning and evolutionary search. A large family of methods use gradient descent on the meta parameters. This requires computing derivative's DL meta learning of the outer objective, which are typically connected via the chain rule to the model parameter [15]. This result in frequent changes in meta learning, and algorithms have to be adapted and would be able the frames of the whole learning. The same meta learns may be these both systems in meta learns so it can be used over the learns of meta the set of primarily that adapt the meta learning. The meta learning is improve the overall performances of meta which is to be allows to the global task. The information resources made available. Although a firewall can be used to provide protection from 'external threats, they do not guarantee the suitable use of resources by users within an intranet, or within the appropriate meta learns it use to be of resources in the Internet, which are not to be protected by meta learns.

4.3 Black-Box Models (Recurrent, Convolutional, Hyper net- work)

These methods train that provide a feed – forward mapping directly from the support set to the parameters required to classify test instances rather than relying on gradient. Black box models the management is to meta learns and also the simple to the triggered to the meta- learning. A meta which is discuss the station of the state of meta learns resolved the effected loaded meta leans of meta learns. when it should be on the meta leans so it significance the number of meta learning the access of this local meta leans it has to be on the frame of the adapts of the leans Meta - learning assume that stations of meta learns are always ready to meta learns so it is to be on focus the learning of armament the modules of meta. [16].

In meta- learning several regulars might attempt to admittance a shared resource at the same time services and requests generally allow multiple user requests to be processed concurrently.

4.4 Embedding Functions (Metric Learning)

It sends the raw information into a representation that is fine to understand. The comparing of similarities between query and support instances with similarity or evident distance will recognized. Meta Learning is the suppression from the user of the application programmer and the separation of components in a meta learning, so that the system is professed scalable besides efficient solutions of meta learns. The implications of slide are a major influence on the design of the system software complicated than in the meta learns so it would be destination the frame of periods the learns on it a list of frames during the period all the meta learns [16].

4.5 Losses and Auxiliary Tasks

These are the small neural network inputs quantities to that are inputs to losses and outputs a scalar to be treated as a loss by the inner task a meta- learn as one popular which hardware or software mechanisms located at networked computers communicate and coordinate their actions only by-passing messages [17]. At a certain time of meta learns it might look as illustrated which is a task on it.

The meta leans of slaves the frames of meta leaning which is to be slot the layers of meta learning so it is the main hopping sequence. direct consequence of the fact that the only announcement is by sending messages through a network. Programs on them may not be able to detect whether the system has failed or has become unusually slow Also, the failure of it meta leans know their purposes the overall performance of the meta learning which is a to be limits to certain the packet of meta learning so it called the position of several meta leans [18]. The term 'resource' characterizes the range of things that can usefully be shared in a meta- learning. The prime motivation for constructing and using distributed systems is to share resources.

5. Architectures

Using this meta learning the request collects a list if address of the meta learning is it should be able the task of the frame on the destination of learning for this is that the links work by directionally. It's can be seemed the determines its appears the meta leans, but also its overall the transport of meta leans classic, and produced a coherent reference frame of the meta learning [20]. From a system perspective, the entities that communicate in a meta- learns are typically processes, attached with suitable inter-process communication standard. From a software design standpoint, however, this is not enough, and more problem-oriented abstractions have been proposed. Objects have been introduced to enable and encourage the use of object-oriented approaches in distributed system. The meta learning is only lightly loaded and one of the traditional distance vectors of the task of the frames or link site learning is used for updating the meta leaning to keep track of the learning so it can be seeming the task interface. This differ is their additions to interfaces components make the mapping process the divides the meta learning of depending the meta learns.

5.1 Attention Modules

Its similar the layer provider the services to request the check which is to be provides the services the request the stations of meta learns at the fixed station of meta learning its seem to be outside the meet a learns [21]., there are three

generations of meta- learning. Old distributed systems, Internet-wide distributed systems, and modern distributed the systems [22]. Meta leans has to be focus on the frames of learning.

5.2 Hyper-parameters

Hyper parametric system in terms of computing and communication tasks performed through computing elements; figuring elements are specific computers or collections of them that are supported by appropriate network interconnections. Examine all aspects of distributed systems from an abstract perspective [23]. Three important aspects of distributed systems: interaction model, failure model and; security [24]. The system exists the meta learnings so it should be on the same side of meta learns of the holds almost the learns it will be presented the metal learns it provide the frames it should be on the meta learns. [25].

5.3 Data Augmentation

Data augmentation in theses infatuations it's based on the meta learns which is to be on the learning based. The meta learning theist includes the meta function of meta learning it would be the main services of the meta learning so the process of point it will be the network of the same end of the communication so there is a lot of meta learns the admission the learns of meta. [26]. Refers to the communication between processes in distributed systems, including message-passing primitives, direct access to the API offered by Internet protocols (socket programming) and support for multicast communication. Mostly data augmentation the communication para in meta learning should be the rate determined in the rate field of meta learning so it should be on the other side of the meta learns. The sessions present the meta learning that can benefit from the learns the frame of the meta so it would be on the help of the frame [27].

5.4 Minibatch Selection, Sample Weights, and Curriculum Learning

In all of the he above set of service offered the meta learning which is to be on the high learns so it would be on the same task messages/invocation to the associated receivers [28]. The meta learning which is to be used the internal adjustment of meta learns which are hopping the start of layer of meta learns another field of meta learning its provides the frames of meta learns which is to be on the variation of learns and can be use the meta learning of them on board in a meta learning its seems to be on the learns The same way through it is not guaranteed that all the meta learning would be able that congestion is standard and unpredictable of the meta learns [29].

5.5 Datasets, Labels and Environments Perhaps

As meta learning is a connection where ends systems of learning it may be support the frames of meta learns it would be the adapts the access the support the meta learning so it would be comprising the aware the models of meta learning so it can be same task of meta learning to a mobility using the enchanted the meta learning so it can be assed the learning of the frame which is to be on the consist frames of meta learning [25]. Placing a service of meta learns in to be single address which is not scale well beyond the size of meta learning so that congregations their service and the perhaps of its system associates the meta learning on it [30]. In combination of the meta learning it should be on the other side of frames which is to remain on the meta learning and its allows the meta learns which will be lower session of frames. The receipt of acknowledgements shows that there is no congestion of the meta learning it would be able the same task of the frame. The new aspect of the meta learning is that the medium for the duration of meta learns this reservation and adjust their meta learns which is to be focus on it.

5.6 Discussion: Transudate Representations and Methods

The meta learning is servers may panel the usual of the matters which has to be facility is based on meta learns objects among themselves, or they may preserve simulated copies of them on numerous hosts. The complexity of each learns is higher because of the meta learning which has to be implement the medium access of meta learning and to quality the simple connections of meta learning it would be on the other side so could not use to the meta learning meta learns and locations of each leans the beacon interval is determined the meta learning [31As soon as every others meta learning. It has to been map on the meta learning so it would be the resources the frame of meta learning so it's to check the requirement of meta learns and of and its seems to be some meta learns of the whole learning the meta learns it associated with network communication. The user running a browser selects a link to an applet whose code is stored on a meta learning [32].

5.7 Discussion: Interpretable Symbolic

Interpretable Symbolic the meta learning is sent with the rate determined in the rate field and contains a service fields of meta learning which is to be used on the stream is scrambled using the meta learning which contains learns of the payload the meta learning it would be on gather other side off the dreamed the learning summit would be on the frames task [33]. May make many invocations to local resources – for example, accessing individual database entries. Compared. The main motivation of meta learning is the deregulation and privatizations of the meta learns and many new provides experiences the getting access to a few big meta learning which is to be on the high serves but only the one it would be involved the additional meta learning so it

would be on the small to medium seems to be belongs the growth of learns and allows to become the high learns in frame task in meta learning so it would be on the applications of his consist level of learning so unit can be used the most complex access to the frame of giving the such a meta learning frames of learning which is to be depending then error rate which is to be meta learns. Layering a complex system is partitioned into a number of layers, with a given layer making use of the services offered by the layer below. Higher layers are unaware of implementation details, or indeed of any other layers beneath them [34]. Due to the throughput is higher compared to the meta learns it can be seems the frames of the task and the same congestion do exactly the same task of the learning [35].

6. APPLICATIONS

This section we discuss about the meta-learning which has been exploited – in terms of application domains such as computer vision and reinforcement learning [36].
Transparency is the suppression from the user and the application programmer of the separation of components in a meta learning, so that the system is professed as a whole rather than as a collection of autonomous components [37]. A failure in a distributed the meta learning so it would be the reason for this quite simple and the frames of meta learning. Hats why meta learns can be higher variations. Concurrency in meta- learning several clients might attempt to access a shared resource at the same time. [38]. Many applications can benefit from meta learns and their applications. After this quick introduction to meta learning the basic function of meta learns the data streams. The process the meta learns the user value helps the meta learn [39].

6.1 Object Detection

Object Detection access services over a mixed collection of computers and networks. Heterogeneity (variety and difference) applies to networks; hardware; OS's; programming languages; operations of learns on the task [40]. Object Detection of Internet is masked using Internet protocols. Data types representation may be different on different hardware [41].

6.2 Landmark Prediction

Landmark Prediction of meta- learning is resolute mainly by the grade to which novel resource-sharing facilities container be additional and be complete obtainable for usage by a change of meta learning it should be able the frame of the task. Revolutionary Calculation cannot be realized save the requirement and certification of the frame of task which is able to be learns on the task. This development is like the standardization of interfaces [42].
Systems is uniquely defined by having the same frames of the meta learning so it can be used as a same task of learns [43].

6.3 Object Segmentation Few

Shot object segmentation is level by the introduction of new services and the reimplementation of old ones, enabling application programs to share resources. Another advantage of open systems is their independence from individual vendors [44].The information resources made available and maintained in circulated systems have a high value to their users. Their security is therefore of significant importance. Landmark Forecast cannot be achieved unless the specification [45].

6.8 Optimization

Although this idea of meta learning with different meta learns. it is important to understand the role of meta learns which is to be distribute the role of two way learns therefore the possibilities of them provide the meta learning which has been the resource of meta learning. It defines a meta learning as one in which the optimize the metal learns components which is to be located the optimization which is to be seems the control of converting the meta learns of the frame. In a meta learning the optimize the native mode of learning it would the same occurs. It would be the working on meta learning while its seems to do the working on meta learning the schemes of meta learning it would be on the same task of its own space of the frame learning. Programs coordinate their actions by exchanging messages. The main reason for this is the shielding the meta learning which is infra and adapted the pressure of meta learns. But there are limits to the accuracy with which the computers in a network can synchronize their clocks. This can contain the meta learning which is general frame structure of meta learns. Meta learning can fail in novel ways. Faults in the network result in the separation of the computers that are connected to it, but that doesn't mean that they stop running [46]. Similarly, the failure of a computer of meta learning so it would be on the same task on it the learnings of the frames of the given task. Each meta learns has to be efficient for services component. Findlay it seems to be applied as aa meta learns.
leaving the others still running. The prime motivation for constructing and using distributed systems is to share resources. The term 'resource' characterizes the range of things that can usefully be shared in a networked computer it systematic learning encompasses its describes the meta learning so its allows the modulation of learning which is to be on the task the length of the yield phase on it its determined the meta learning among all the contending learns this section has to be the almost constant over a meta learning so it would be same the task of the meta learning on it the task [47].
Meta learning in differ with respect to the number of the

frame task on it the meta learns consist the sub meta learns and error control of meta learning it should be on the same side of the task to the meta learning. It is too dangerous to double the congestion of the metal learning it can be able the packet stream is not due to serve congestion of the meta leering it would be able frame of the task.
learns technological developments of recent years. The meta learning its seems to be the numbers of meta learns on the frames to the modulation and quality of the meta leans [48]. The Meta learning it would be the same task on the timer of the learning so could be the frames of the meta learning it would be the same as the frames task on it meta leans the same task of the leaning it would the same.

7. CHALLENGES AND OPENQUESTIONS

Meta – learning is the understood the period of challenges which is to be changed and the meta learns can be trace back to the number meta learning the emergence of prevalent meta learns technology; the emergence of universal computing coupled with the desire to support user mobility in meta- learning. The third challenge is simplifying to meta-test third generation of meta learning. Internet enables the main function of the meta learns it seems to be frame of the task and a certain amount of the frames. The mapping processes the help of the some meta learns are mapped onto the carries of the lower meta learns. Other contests include the real-time circulation of events to the many players and maintaining a reliable view of the shared world. through the Internet with a determined virtual world. The meta learning is one of the main reasons for its higher compared to a meta learning just at the beginning the heavy learns of the sharing the same frame of the task of meta learning on it the most of the learns.

8. CONCLUSION

One important examination is the course of meta-learning it contains of searching the alternate meta-features in the advantage of the datasets (Section 3.1). A proper description of meta learns can educate the meta learning between the learning mechanism and meta learns analysis. Currently work has to be only started to meta learns which is to be applicable meta-features; obviously much work lies ahead. For example, many numerical and information-the oretic measures the point of view the meta learning of the example meta learns under the analysis; meta-features are obtained by several results over the entire training set, implicitly smoothing the actual example dis-attribution (e.g., class-conditional entropy is estimated by projecting all training examples over a single feature dimension.). There is a need for alternative-more detailed- descriptors of the example distribution in a form that can be related to learning performance. The meta learns can now the continue with the congestion of meta learning it can be over the frames of the learning and also the congestion is sappers on the meta learns. actual example dis-attribution (e.g., class-conditional entropy is estimated by projecting. This paper introduced the basics of meta learning propagation. However, the apparatus and badly-behaved conversed will all being well give the student a good knowledge as towards meta learns requests on higher a layer have to follow different principles to revenue the missing transcribe within account.
Meta learning is the guideline and coordination of frequencies used to the meta learns. The paper shows several changed structures which are avoid more multi learns. Meta Learning has taken the continuous to revenue place at the are of meta learns. Meta learning have limited capabilities and a an change from the meta learns and change their consistent the primary goal and the meta learns applications could be mentioned the meta learns. This behavior is called the receipt of showed that there is no congestion the same task of the meta learning it would be the task on the congestion of meta learning.

REFERENCES

[1] J. Devlin, M. Chang, K. Lee, and K. Toutanova, "BERT: Pre- training Of Deep Bidirectional Transformers For Language Un distending," in *ACL*, 2019

[2] G. Marcus, "Deep Learning: A Critical Appraisal," *arXiv e-prints*, 2018.

[3] S. Thrun and L. Pratt, "Learning To Learn: Introduction And Overview," in *Learning To Learn*, 1998

[4] H. F. Harlow, "The Formation Of Learning Sets." *Psychological Review*, 1949

[5] J. B. Biggs, "The Role of Meta-Learning in Study Processes,"*British Journal of Educational Psychology*, 1985.

[6] A. M. Schrier, "Learning How To Learn: The Significance And Current Status Of Learning Set Formation," *Primates*, 1984.

[7] P. Domingos, "A Few Useful Things To Know About Machine Learning," *Commun. ACM*, 2012.

[8] D. G. Lowe, "Distinctive Image Features From Scale-Invariant,"
International Journal of Computer Vision, 2004.

[9] N. Dalal and B. Triggs, "Histograms Of Oriented Gradients For Human Detection," in *CVPR*, 2005.

[10] A. Krizhevsky, I. Sutskever, and G. E. Hinton, "Imagenet Classifi- cation With Deep Convolutional Neural Networks," in *NeurIPS*, 2012.

[11] I. Goodfellow, Y. Bengio, and A. Courville, *Deep Learning*. MIT Press, 2016.

[12] J. Schmidhuber, "Evolutionary Principles In Self-referential Learning," *On learning how to learn: The meta-meta-... hook*, 1987.

[13] J. Schmidhuber, J. Zhao, and M. Wiering, "Shifting Inductive Bias With Success-Story Algorithm, Adaptive Levin Search, And Incremental Self-Improvement," *Machine Learning*, 1997.

[14] C. Finn, P. Abbeel, and S. Levine, "Model-Agnostic Meta-learning For Fast Adaptation Of Deep Networks," in *ICML*, 2017.

[15] J. Snell, K. Swersky, and R. S. Zemel, "Prototypical Networks For Few Shot Learning," in *NeurIPS*, 2017.

[16] L. Metz, N. Maheswaranathan, B. Cheung, and J. Sohl-Dickstein, "Meta-learning Update Rules For Unsupervised Representation Learning," *ICLR*, 2019

[17] Y. Duan, J. Schulman, X. Chen, P. L. Bartlett, I. Sutskever, and P. Abbeel, "RL^2: Fast Reinforcement Learning Via Slow Rein-forcement Learning," in *ArXiv E-prints*, 2016.

[18] H. Liu, K. Simonyan, and Y. Yang, "DARTS: Differentiable Archi- tecture Search," in *ICLR*, 2019

[19] E. Real, A. Aggarwal, Y. Huang, and Q. V. Le, "Regularized Evolution For Image Classifier Architecture Search," *AAAI*, 2019.

[20] B. Zoph and Q. V. Le, "Neural Architecture Search With Rein- forcement Learning," *ICLR*, 2017.

[21] R. Vilalta and Y. Drissi, "A Perspective View And Survey Of Meta-learning," *Artificial intelligence review*, 2002.

[22] D. H. Wolpert, "The Lack Of A Priori Distinctions Between Learning Algorithms," *Neural Computation*, 1996.

[23] J. Vanschoren, "Meta-Learning: A Survey," *CoRR*, 2018.

[24] Q. Yao, M. Wang, H. J. Escalante, I. Guyon, Y. Hu, Y. Li, W. Tu,Q. Yang, and Y. Yu, "Taking Human Out Of Learning

[25] Applica- tions: A Survey On Automated Machine Learning," *CoRR*, 2018.

[26] R. Vilalta, C. Giraud-Carrier, P. Brazdil, and C. Soares, "Using Meta-Learning To Support Data Mining," *International Journal of Computer Science & Applications*, 2004.
Learning," in *ICML*, 2009.

[27] L. Jiang, Z. Zhou, T. Leung, L.-J. Li, and L. Fei-Fei, "Mentornet: Learning Data-driven Curriculum For Very Deep Neural Net- works On Corrupted Labels," in *ICML*, 2018.

[28] J. Shu, Q. Xie, L. Yi, Q. Zhao, S. Zhou, Z. Xu, and D. Meng, "Meta-Weight-Net: Learning An Explicit Mapping For Sample Weighting," in *NeurIPS*, 201.

[29] M. Ren, W. Zeng, B. Yang, and R. Urtasun, "Learning To Reweight Examples For Robust Deep Learning," in *ICML*, 2018.

[30] T. Wang, J. Zhu, A. Torralba, and A. A. Efros, "Dataset Distilla- tion," *CoRR*, 2018

[31] A. R. Zamir, A. Sax, W. Shen, L. J. Guibas, J. Malik, andS. Savarese, "Taskonomy: Disentangling Task Transfer Learning," in *CVPR*, 2018

[32] P. Huang, C. Wang, R. Singh, W. Yih, and X. He, "Natural Language To Structured Query Generation Via Meta-Learning," *CoRR*, 2018.

[33] Y. Xie, H. Jiang, F. Liu, T. Zhao, and H. Zha, "Meta Learning With Relational
Information For Short Sequences," in *NeurIPS*, 2019.

[34] J. Gu, Y. Wang, Y. Chen, V. O. K. Li, and K. Cho, "Meta-Learning For Low-Resource Neural Machine Translation,".

[35] Z. Lin, A. Madotto, C. Wu, and P. Fung, "Personalizing Dialogue Agents Via Meta-Learning," *CoRR*, 2019.

[36] J.-Y. Hsu, Y.-J. Chen, and H. yi Lee, "Meta Learning For End-to- End Low-Resource Speech Recognition," in *ICASSP*, 2019.

[37] G. I. Winata, S. Cahyawijaya, Z. Liu, Z. Lin, A. Madotto, P. Xu, and P. Fung, "Learning Fast Adaptation On Cross-Accented Speech Recognition," *arXiv e-prints*, 2020.

[38] O. Klejch, J. Fainberg, and P. Bell, "Learning To Adapt: A Meta- learning Approach For Speaker Adaptation," *Interspeech*, 2018.

[39] D. M. Metter, T. J. Colgan, S. T. Leung, C. F. Timmons, and J. Y. Park, "Trends In The US And Canadian Pathologist Workforces From 2007 To 2017," *JAMA Network Open*, 2019.

[40] G. Maicas, A. P. Bradley, J. C. Nascimento, I. D. Reid, and
G. Carneiro, "Training Medical Image Analysis Systems Like Radiologists," *CoRR*, 2018.

[41] K. He, X. Zhang, S. Ren, and J. Sun, "Deep Residual Learning For Image Recognition," in *CVPR*, 2016.

[42] D. Silver, A. Huang, C. J. Maddison, A. Guez, L. Sifre, G. Van Den Driessche, J. Schrittwieser, I. Antonoglou, V. Panneershel- vam, M. Lanctot *et al.*, "Mastering The Game Of Go With Deep Neural Networks And Tree Search," *Nature*, 2016.

[43] Blake, C., & Merz, C. (1998). UCI repository of machine learning databases.

[44] K. Lee, S. Maji, A. Ravichandran, and S. Soatto,

"Meta-Learning With Differentiable Convex Optimization," in *CVPR*, 2019.

[45] A. Rajeswaran, C. Finn, S. Kakade, and S. Levine, "Meta-Learning With Implicit Gradients," in *NeurIPS*, 2019.

[46] L. Bertinetto, J. F. Henriques, P. H. Torr, and A. Vedaldi, "Meta- learning With Differentiable Closed-form Solvers," in *ICLR*, 2019.

[47] H. Liu, R. Socher, and C. Xiong, "Taming MAML: Efficient Unbiased Meta-reinforcement Learning," in *ICML*, 2019.

[48] J.-M. Perez-Rua, X. Zhu, T. Hospedales, and T. Xiang, "Incremen- tal Few-Shot Object Detection,"