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TOWARD A CONCEPTUAL METAPHORS MODEL TO SUPPORT THE IOT-DATA ANALYSIS PROCESS

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ABSTRACT

The analysis and processing of IoT data is related to its changing behavioral nature. Thus, describing the behavior of data to infer how it is presented can reduce the load on processing and analysis resources for more efficient performance. Therefore, the adoption of a particular technology has become an insufficient measure, which necessitates the transition to the mode of research in other related fields. In this paper, we present a conceptual metaphors (CMS) architecture to support the IoT data consistency process. This model aims to create metaphorical relationships between data that connect entities to describe and produce meaning, based on the study of the possibility of combining concepts of metaphor and semantic approach. It can provide suggestions on how to improve the use of resources as a service to deal with massive IoT data. Moreover, adopting this metaphorical mechanism can enable developers and designers to design and re-architecture adapted to the nature of this data. The results of the analytical study show that our proposed model has high descriptive features that make it more efficient than other existing models.

Keywords: *IoT-data, Cloud, conceptual metaphors, Sensors networking, Resources overload, Big data.*

1. INTRODUCTION

Internet of Things (IoT) technology looks to connect most things together in order to produce data that supports informed decision making in many areas such as health, agriculture, manufacturing and more [1.,2]. As current technologies are able to process only a limited portion of IoT data. These data produced from different and heterogeneous sources need to be processed and analyzed with high efficiency. It can be said that the analysis and processing of data is related to its changing behavioral nature [3] .This means that describing the behavior of data and the way it is presented can improve the efficient allocation of resources for its processing and analysis, such as cloud resources. It indicates that there is a relationship between the process of allocating computing resources and how data is represented. Thus, finding a method that describes and represents the data is essential for allocating and automating computing resources in cloud.

Many questions and challenges are introduced as follow:

Is programming alone sufficient to deal with internet data...? Or does it go beyond that to what is physical?

What can an ontology offer us to improve the performance of resources dedicated to data processing?

Can data processing weaknesses be linked to current software designs and models?

What are the ways to build new models to improve the performance of existing models?

Can we not say that the relationships extracted under the existing models of analysis are not sufficiently accurate?

Can we limit the process of linking concepts to one method? Or are there other methods that contribute to the emergence of new concepts that can answer a number of questions?

Can we take advantage of metaphor-based visualizations to develop a model that is more efficient in dealing with IoT analysis/processing/storage?

Although the Cloud computing technology offer important services for data processing and storage, sometimes cloud resources are overloaded, (CPU, Servers, Virtual Machines…).

Also, MapReduce as a model used in cloud for large-scale distributed data processing [4,5]

Therefore, the adoption of a specific technology has become an insufficient procedure, which necessitates a transition to the research pattern in other related fields. Thus, finding mechanisms that reduce, describe these data behaviors is an important and promising stage. The abstract semantic relationships enable correlation between data in order to infer focused patterns of information. Linking events, results and concepts produces meaning that is determined by a known context. (e.g., Bayesian Theorem). Other example which combining “atoms” produces the meaning of “molecules” and the seeds with water and temperature gives the fruits. Thus, describing a meaning or concept related to a separation and re-installation of its parts according to (adding, canceling, or deleting one or more parts). For example, data scientist uses their analytical and technical capabilities to extract meaning insights from data while data Engineer, ensure uninterrupted flow of data between servers and applications [6].

The ontology generates this detail (conceptualization), which establishes the meaning of every concept, term and utterance in the field. The concepts are placed in a graphic model of terms and synthetic and rhombic relations (semantic). In web science, metaphors can be used to support graphic structures that present information in a way that is more accessible and easier to interpret for humans [7]. In this paper, we introduce an architecture, Conceptual Metaphor Structure (CMS) to support the IoT-Data consistency process. The Metaphor is a semantic transformation, enriching the meanings of language, renewing its structures, and performing basic functions, whether at the semantic or pragmatic level, and among these functions: the embodied function, the argumentative function. A study done by researchers on semantic inference processes while understanding metaphor in order to understand complex sentence. In learning, people develop new cognitive structures by metaphorically extending old ones. The metaphors spontaneously generated by new users will predict the ease with which they can master a computer system [8]. The authors present the first integrated open-domain statistical model of metaphor processing in unrestricted text [9]. Adoption of metaphorical computational processing in real-world NLP supports the processing of semantic tasks [10,11]. we define a metaphorical approach that aims to support information systems. It can be considered as a high level of abstraction beyond the finite description. This model aims to Create metaphorical relationships between data that connect entities to describe and produce meaning. Thus, given an idea on how to improve the use of resources as a service to deal with this massive IoT-data. Further, creating models that adopt a metaphorical approach to design and reengineer software adapted to the nature of this data.

The remainder of this paper is organized as follows: section 2 reviews the relevant literature. Section 3 introduces a comparison between the semantic and metaphor concepts, and describes phases to construct a conceptual metaphorical model. Section 4 discuss a main work based on metaphor concepts. Section 5 concludes the paper and points out some future work.

2. LITERATURE REVIEW

2.1 IoT and metaphors concepts

One of the main challenges of successful big data applications on the cloud is to configure efficient storage platforms and efficient infrastructure. Where cloud services seek or attempt to reduce the use of resources at the lowest cost, most responsiveness and ease. But some of its services fail to handle IoT data in storage and processing states. At this level, prediction-based models can support cloud storage services, and also helps in early identification of the volume of data and its sources. This early identification enables the identification of data behavior and characteristics in contexts. In addition to deducing alternatives to improve data storage services. Despite the development of the early prediction mechanism in determining the behavior of the data, it fails if new behaviors appear. In this work, the authors provide a thorough overview on using a class of advanced machine learning techniques, namely Deep Learning (DL), to facilitate the analytics and learning in the IoT domain [12]. In this work the authors evaluate some of the values and assumptions encoded in the framing of the term big data, drawing on the framework of the conceptual metaphor [13]. He sees that the adoption of analogy as tools from the point of view of metaphors supports the process of learning the conceptual change of things [14]. According to the authors, identifying the relationships between related concepts in a specific ontology model is necessary in order to use them as a basis for semantic reasoning [15].

2.2 Cloud resources

The authors propose RTSLPS to handle different kinds of changes associated to fluctuations at users' level or at the server level. RTSLPS real-time server load prediction system was able to handle different kinds of changes while delivering good accuracy in short completion time. Problem of efficient resources usage when overloaded servers in cloud computing. The processes adopted which monitor users' behavior based on incoming trend detection that aims to classify the incoming tasks. The experimentation showed that our approach was able to maintain an accurate prediction facing concept drift with a short response time. Classifying tasks based on users' behavior (just one criteria) [16]. The authors propose a new cloud and software-defined networking (SDN)-based manufacturing model named software-defined cloud manufacturing (SDCM), which transfers the control logic from automation hard resources to the software. The time-sensitive data traffic control problem of a set of complex manufacturing tasks. The transmission of heterogenous Internet of Things (IoT) data that enable the management of the critical network congestion (latency….). The authors suggest to formalize the time-sensitive data traffic control problem of a set of complex manufacturing tasks, considering subtask allocation and data routing path selection. Using a genetic algorithm (GA), Dijkstra's shortest path algorithm, and a queuing algorithm. In the SDCM, the results based on this algorithm show the efficiently prevent network congestion and reduce the total communication latency [17]. By modelled the CoT resources on the IaaS and PaaS levels, the selected the OCCI standard due to its extensibility and comprehensive modelling of the cloud are developed. The proposed solution for resources Provisioning Model. An alternative solution that provides a coordinated one-stage provisioning of IoT application in the CoT infrastructure. The results show that a holistic provisioning process proves to be 10%−20% more efficient than two separate orchestration processes for cloud and IoT resources respectively [18]. Due to a large number of data users as well as limited resources and heterogeneity of data devices in Internet of Things (IoT), existing access control schemes for the cloud storage are not effectively applicable to IoT applications. The authors propose a CP-ABE-based storage model for data storing and secure access in a cloud for IoT applications. This framework introduces an Attribute Authority Management (AAM) module in the cloud storage system functioned as an agent that provides a user-friendly access control and highly reduces the storage overhead of public keys. The Advantage of this work is that the computational overhead of a user is immensely decreased [19]. The network concept drifts resulting from changing user demands are among the problems affecting cloud computing. The cloud data center needs agile and elastic network control functions with control of computing resources to ensure proper virtual machine (VM) operations, traffic performance, and energy conservation. The authors introduce a resource management technic based on Software-Defined Network (SDN) that aims to handle cloud services allocation in a dynamically environement [20]. Software-Defined Network (SDN) proffers new opportunities to blueprint resource management to handle cloud services allocation while dynamically updating traffic requirements of running VMs. The authors analyze resource allocation mechanisms utilized by various researchers and categorize and evaluate them based on the measured parameters and the problems presented. Further information about the possible cloud computing strategies relevant to IaaS resource allocation. The problem of using cloud computing resources for services is related to planning the amount of resources needed and their subsequent reservation. The authors propose a strategy used to support machine learning methods when planning cloud resource reservation for network services [21]. In the IoT-Fog-Cloud landscape, IoT devices are connected to numerous software applications in order to fully operate. Some applications are deployed on the Fog layer, providing low-latency access to resource. Orchestrating Cloud and Fog is a key concept aiming at optimizing the use of resource pools available at both layers in order to accurately meet the underlying IoT requirements. The IoT environment is of a highly dynamic nature. Due to their intrinsic properties, the Cloud layer fails/ ensuring low-latency requirements. The authors propose a rewriting-based approach to design and verify the Cloud-Fog self-adaption and orchestration behaviors for optimizing the use of resource pools in order to accurately meet the underlying IoT requirements. Because of the Cloud layer fails ensuring low-latency requirement. And also, the authors rely of the formal specification language Maude to provide an executable solution of these behaviors basing on the rewriting logic and

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we express properties with Linear Temporal Logic (LTL) to qualitatively verify the adaptations correctness [22].

2.3 Cloud IoT Applications

The development of cloud-computing technologies has enabled earth scientists to easily use numerical ocean models that require high-performance computing (HPC) and message-passing interface (MPI) software in private and public clouds.

The emergence of the next generation cloud computing architectures generates voluminous amount of data that are beyond the capability of the hallow intelligent algorithms to process. However, the optimal selection of virtual machines (VMs) to process a medical request represents a big challenge. Optimal selection of VMs performs a significant enhancement of the performance through reducing the execution time of medical requests (tasks) coming from stakeholders (patients, doctors, etc.) and maximizing utilization of cloud resources. The data-intensive Power Workflow (PW) needs massive computing resources. The authors propose the Non-dominated Sorting Deferential Evolution (NSDE) that is used to generate placement strategies [23].

2.4 Application based metaphors concepts

Emphasis on data analysis has become an important procedure in many computing and decision-making processes. At this level we mention some research that dealt with building on two new interface metaphors that were originally developed for navigating in databases, the directories metaphor and dynamic queries. The Guides metaphor was developed at Apple to reduce the cognitive load on learners navigating a large hypermedia database. Within Alice the Guides metaphor use to allow online shoppers to interact with the system in a variety of ways.

The advantage of the allegorical method is that it links relationships between entities with the fewest number of words.

Thus, it is in line with scientific language that tries to avoid synonymy (avoiding expressing one concept with more than one term) and common verbalization (avoiding expressing several concepts with the same term) [24]. Scientific language, which is a tool used in information technology. For example, the methods in which the computer deals with the implementation of commands are limited, which reduces the opportunity to construct more abstract meanings. The contexts are related to the production of big data and how to deal with it with the available methods. The metaphor will make us redefine some of the features that were adopted before due to the emergence of contexts that forced the reconsideration of several rules in several areas. The metaphor will make us redefine some of the features that were adopted before due to the emergence of contexts that forced a reconsideration of several rules applied in different fields.

3. PROPOSED SOLUTION

In this section, we introduce a model based on conceptual metaphorical structure and IoT data characteristic. This work proposes a conceptual metaphorical model to support analyzing and processing IoT data. Also, we construct a dictionary that aims to describe data behaviors based on conceptual metaphor proposed by Lakoff and Johnson.

3.1 IoT data characteristics

We start with an analysis of IoT data characteristic and then present a data management reference model for IoT. IoT Data shares five distinct characteristics:

- Heterogeneity. The comportment of things is described by the coming information which IoT uses unstructured and semi structured data types [28].
- Inaccuracy. The inaccuracy of the data produced is an interesting factor that limiting the wide spread adoption of IoT [29]. For example, experiments show that RFID systems is an example that can only capture 60% to 70% correct data [30].
- Massive Real-Time Data: IoT is designed to connect enormous of things in large scale. Communications between different entities in dynamic networks generate a large volume of heterogeneous data in the form of real-time, high-speed, uninterrupted data streams. Scalable storage, filtering and compression schemes are essential for efficient big data processing [31].
- Implicit Semantics: Natural IoT data is of low-level with weak semantics [32]. In order to support higher-level applications, such as smart home and intelligent healthcare, complex semantics need to be abstracted in event-driven perspective from the mass of low-level data.

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3.2 Semantic and Metaphorical model

Justifications for adopting a model based on metaphorical structures, because metaphor is present in the abstract scientific language, as it is present in the language of literature. With the difference between them, Therefore, relying on a model that integrates metaphorical relationships will be more general and comprehensive than a model that evaluates relationships between data on the basis of semantic processing.
In addition, the semantic model studies the components of data, while the metaphor-based model studies the components and the relationships that link them.

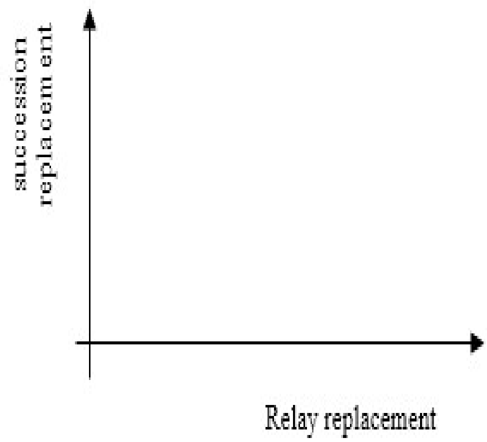

Figure 1: Speech-language pathologies based on De Saussure's model.

Speech-language pathologies heal according to the work of Ramon Jacobson are illustrated in Figure 1. Based on de Saussure's concepts, metaphor is generally associative in its feature, and exploits the horizontal relations of language, and Jacobson's concept stems from De Saussure's view of language in the sequential and associative domains in linguistic performance. The succession replacement and the relay replacement are illustrated in table 1 and table 2.

Table 1: Example of how the vertical replacement axis works

The man	smiled
The wall	smiled
The lucky	smiled
The day	smiled

→

The man	smiled
The wall	
The lucky	
The day	

Table 2: Working model of how the horizontal substitution axis works

Mohamed	entred	to	home
Zayd	entred	at	school
Zayd	entered	to	house
Zayd	Get-in	to	section

Table 3: Metaphorical dictionary work model.

Peace field	Relationship	War field
Cooperation, security, peace, mercy, helping hand, coexistence, brotherhood	A relationship of dissonance and contradiction	Tank - Cannon - Pistol - Ammunition - Catapult - Spear - Sword - Warrior - Military...

The systematic mechanisms used for constructing illustrates in table 3. Firstly, it classifies items according to the particular field it belongs to, based on the common relationship between them.

The items classified in the same field should share one link at least. The aim of this classification is excluding intended items by the program, to which the user doesn't care. In our case the items of peace will be excluded, and maintain items of war which signify frightening or danger as the table 4.

Table 4: Metaphorical dictionary work model.

Data	Nature of relationship	Decision
Knife - bomb - bullets - pistol - sweets ...- shoes	According to the nature of the observed object: contrast / dissonance	contradiction message: warning sound /Text message

The process of exclusion and reduction adopted by metaphorical program are demonstrated in table 4.

It reduces all items of war in one word as (danger), and which lead to make decision of warning.
For more clarification, table 5 introduces another model in agriculture field (e.g. irrigation systems):

Ontology metaphors, and in particular the metaphors of entity and matter, are always present in our thought to the extent that we take them as axioms and consider them as direct descriptions of mental phenomena, while they represent a dominant system over the mechanisms of our language and allow us to understand a large and diverse number of experiences related to non-human entities by means of stimuli and properties and human activities.

Table 5: Metaphorical dictionary work model.

The result (watering and its nature)	Relationship	Reasons for watering the olive tree
Fast watering	Causation	Temperature reach T=50°
Medium watering	Causation	Temperature reach T=40°
Slow watering	Causation	Temperature reach (T=30°)
Slow watering	Causation	Temperature reach (T=20°)
Slow watering	Causation	Temperature reach (T=15°)
Slow watering	Causation	Temperature reach (T=10°)
Stop watering	Causation	Temperature reach (T=5°)
Slow watering	Causation	Soil moisture is high
Medium watering	Causation	Soil moisture is low
Watering stop	Causation	Fast cold wind
Fast watering	Causation	Fast dry wind
Dependence on humidity and heat	Causation	Fast semi-dry wind
Medium watering	Indirect causation	Medium velocity cool wind
Fast watering	Indirect causation	Medium speed dry wind
Medium watering	Indirect causation	Medium speed semi-dry wind

To get an idea of how metaphorical expressions in everyday language can give us insight into the metaphorical nature of the concepts that structure our everyday activities of [25] that consider the metaphorical concept "TIME IS MONEY" as it is reflected in contemporary English:

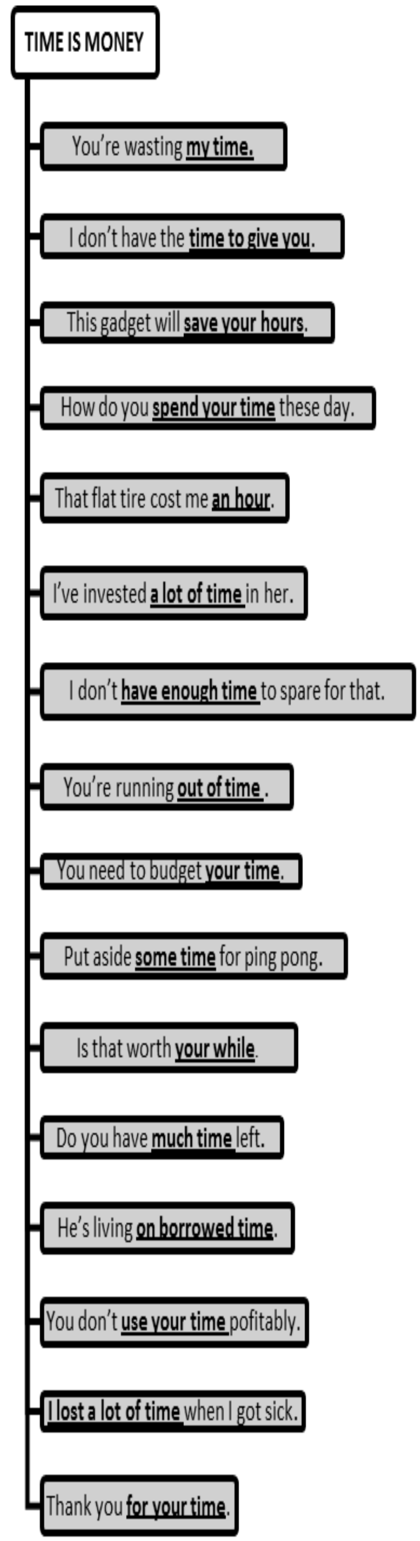

Figure 2: Information model based on conceptual metaphor proposed by Lakoff and Johnson

How the big metaphor (TIME IS MONEY) work:

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There are a number of mandatory links that facilitate the process of linking money and time, as shown in table 6.

Table 6: comparative between time-money features

Money	Time
Money is running out	Time has an end
Money countable	Time is measurable
Money is the backbone of human life	Time represents the life span of a person
	Time can be wasted
Money is wasted	Time working time
Money is the result and fruit of work	Time gives
Money to be truste.	....
......	......

The major metaphor "time is money", is a process of reduction and condensation of minor metaphors that appear in our daily use, which is what we are looking for in data processing: seeking to propose a model that reduces the data that is capable of that.

In the sense that metaphor works to intensify meanings and reduce them with the least number of words, and we also want to reduce and merge the largest number of mergeable and reducible data, and in order to clarify how the metaphorical model works in dealing with the data that results from applications, we suggest the model for dealing with the data generated by the receptors responsible for the delicate watering process, for example; The table shows us the most important data taken into consideration in the irrigation process. Give each rating a metaphor indicating the degree of severity. We can consider that there are things and processes that occur within natural systems that are difficult to monitor. These subtle notes can support system information. The allegorical method attempts to link things and events together to elicit specific explanations and details.

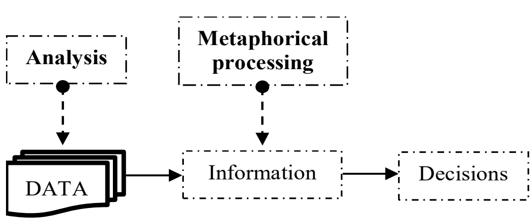

Figure 3: Metaphorical process model for IoT data analysis.

In the above scheme; IoT-data has been collected and analyzed, and then we obtain information which varied according to the its importance and accuracy. The proposed metaphorical model intervenes to reduce the information to a higher level in terms of abstraction, which is able to deal with computing, and thus becomes ready for applications so as to be used for efficient decision-making.

4. DISCUSION

why we chose de system metaphorical in our proposition, because We have found that most of our ordinary conceptual system is metaphorical in nature. And we have found a way to begin to identify in detail just what the metaphors are that structure how we perceive, how we think, and how we do., [26], and that have relation with a grammar rule. It is an open question how rules of grammar are to be incorporated into a model of performance, and hence into a theory of neural instantiation. Here are three plausible options. Rules are (in some sense) explicit in long-term memory within the f-mind, and language processor explicitly refers to them in constructing and comprehending utterances Following the computer metaphor, rules are like-data structures in a computer. Rules are partial description of operations of the processor itself. In the computer metaphor, the rules as we write them are high-level descriptions of the processor's program. Rules are implicit in the f-mind; they describe emergent regularities (perhaps statistical regularities) among more basic elements, but are not themselves implemented in direct way [27]. So, the solution which has given by Cognitive linguists, that she speaks about image-schemas as lying at the core of people's understanding of events and the metaphorical extensions of these concepts to more abstract realm [33]. Starting from the baseline of embodied experience, we construct our mental universe (in all its vast complexity) though many levels of elaboration involving capacities such as schematization, generalization, metaphor, and conceptual blending. The metaphor allows us to export a conceptual structure from the more specific domain to the more abstract target domain [34].

Depending on its transformative ability, the metaphorical method can be adopted to reduce big data by creating interrelationships. These relationships would provide data with a high level of description and in short terms. It can be used in the field of artificial intelligence as an approach that supports decision-making processes in several areas. The conceptual metaphor will make us redefine some of the features that were adopted before due to the emergence of contexts that forced a reconsideration of several rules applied in different fields.

5. CONCLUSION AND FUTURE WORK

In this paper, we introduce an approach based a conceptual metaphor model. This approach can be used to support both IoT data description and representation. Also, it can aim to support both data science and information technologies due to its high-level abstract features in diagnosis and description. The main contributions of the research are: Construct Metaphorical dictionary work model; Describe model based on conceptual metaphorical structure proposed by Lakoff and Johnson; Introduce a metaphorical process model for IoT data analysis.

As future work, we can use the concept metaphorical to analyses unstructured data as well as to support information search process in web server in order to access information efficiently. Also, we can develop an architecture for smart IoT devices communication. Adopting a mechanism of conceptual metaphors in order to facilitate the process of accessing big data. The purpose is to facilitate the search process for the user for Example the web servers support search engines which when a word or sentence is written the server performs search operations to find the desired meaning or the desired page. The web browser searches by adopting methods that simulate the human mind. It depends on very complex algorithms to determine the required content. And it proposes to the user results based on possibilities that can achieve even roughly the goal sought. about him.

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