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COMPARATIVE ANALYSIS OF DIFFERENT ARGUMENTATION FRAMEWORKS

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Abstract- By Argument we mean persuasion of a reason or reasons in support of a claim or evidence. In Artificial Intelligence computational argumentation is the field dealing with computational logic upon which many models of argumentation have been suggested. The goal of Argumentation Mining is to analyse the process of 'human reasoning' through which humans rationally accept or reject an argument, opinion or a theory. It may be the next breakthrough in the field of Artificial Intelligence dealing with the building of sophisticated Argumentation Mining systems capable of maintaining structured knowledge representation in open domains from the unstructured data.

Keywords – Artificial Intelligence, Human intelligence, Argumentation Mining

1. Introduction

"Knowledge is a major bottleneck to Argument Mining, giving a controversial issue and a set of texts in which arguments can be found." [Lippi and Torroni, 2016a] Argumentation can be defined as a discourse activity aimed at increasing or diminishing the worthiness of a disputable claim or some perspective. It is an intelligent task with respect to communication that is inherent to human behavior. In the field of Artificial intelligence(henceforth, AI), the study of argument gave birth to a new field called as computational argumentation which has now turned into a prominent field in the research and study of AI because it has the ability to combine figurative needs with the cognitive models which represent tasks defined by user and computational models based on automated reasoning.AM is becoming one of the core study and research area in the field of cognitive sciences, where some studies have indicated that the functioning of the human brain itself is argumentative. According to P.M Dung, one of the pioneers in argument computation and most of the recent studies on abstract argumentation are based on Dung Framework," The natural human reasoning is argumentative itself". There have been some other models which do suggest agent-based simulation in the field of computational social-sciences whose micro foundation specifically refers to various argument theories proposed in literature.[Gabbriellini and Torroni 2014].

One of the other most promising field of AM is taking out inferences from legal texts , where the judgments given by court runs into several hundred or thousands of pages and inference has to be drawn from the judgment , in where human intervention may take a lot of effort and time , however, with AM this process is simplified

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2. Overview of The Research

Argumentation mining can be defined as, "Analysis of the text on the realistic level and then applying an argumentation theory on the model and analyzing the given data" [23]. Literature is abundant on argumentation models, but it cannot be said that a perfect model has been achieved till now, however, research is taking new dimensions, and many models have been proposed. In this field different models have been developed during the past years which can be categorized mainly into three different categories –

2.1 Monological Models

This model assumes a tentative proof of a given argument and then applying a set of rules on its internal structure. Several models based on this approach which addresses the internal structure have been developed [4, 5, 6].These models tries to establish a link between the different components of the arguments and how the conclusion relates to the given premises or a set of premises. Their main focus is on the relationships which can exist in between the different components of the argument in a monological structure. Therefore, these types of models are known as Monological Models. One of the best monological model is that of Toulmin [7].

2.2 Dialogical Models

A second stream of research in AI has stressed on the existing relationships between the arguments, which at times is considered as abstract entities and totally discarding their internal structure. Since, these types of models emphasize on the argument structure similar to a dialogical framework, hence the name Dialogical Model. Many dialogical models have been proposed, to name a few are that of, Dung [4], Bentahar[9], Hamblin[7]; MacKenzie[8].

2.3 Rhetorical Models

In general, dialogical and monological models consider the macro (external) and micro (internal) structure of the arguments. Some of the models do not follow both of these two approaches. These models are called rhetorical models which follow the rhetorical structure of arguments (schemas or rhetorical patterns). In these models, the aim is to take into account the way of using the arguments for the purpose of persuasion.

Approaches	Component Detection		Relations prediction
	Sentence Classification	Boundaries Detection	

Support Vector Machine (SVM)	[Mochales and Moens, 2011], [Duthie et al., 2016], [Lippi and Torroni,2016a; 2016c], [Habernal and Gurevych, 2017], [Bar-Haim et al., 2017]	[Mochales and Moens, 2011], [Lippi and Torroni, 2016c]	[Naderi and Hirst, 2015] [Niculae et al., 2017] [Stab and Gurevych, 2017] [Menini et al., 2018]
Parsing algorithms (P)	[Villalba and Saint-Dizier, 2012], [Peldszus and Stede, 2015], [Eger et al., 2017]	[Eger et al., 2017]	[Villalba and Saint-Dizier, 2012], [Peldszus and Stede, 2015], [Eger et al., 2017]
Logistic Regression(LR)	[Levy et al., 2014], [Rinott et al., 2015], [Nguyen and Litman, 2018]	[Dusmanu et al., 2017], [Ibeke et al., 2017], [Nguyen and Litman, 2018]	[Nguyen and Litman, 2018]
Recurrent Neural Networks for language models (RNN)	[Eger et al., 2017]	[Eger et al., 2017]	[Niculae et al., 2017], [Eger et al., 2017]
Maximum Entropy models (ME)	[Mochales and Moens, 2011], [Duthie et al., 2016]	[Mochales and Moens, 2011]	
Conditional Random Fields (CRF)	[Stab and Gurevych, 2017]		
Naïve Bayes (NB),	[Duthie et al., 2016]		
Random Forests (RF),		[Dusmanu et al., 2017]	
Textual Entailment Suites (TES)			[Cabrio and Villata, 2013]
Maximum Likelihood (ML),			[Levy et al., 2014]

Table 1: A comparison of the approaches applied to AM tasks. They are ordered starting from the most frequently applied methods. As for other tasks in NLP, SVMs have proved to be the most performing algorithms in different settings, and for different AM sub-tasks.

3. Results and Findings

Research work carried out focused on the study of accuracy rates generated by several algorithms i.e. Support Vector Machine (SVM), Linear Regression (LR), Naive Bayes (NB), Decision Tree (DT), Random Forest (RF), Recurrent Neural Network (RNN), Conditional Random Fields (CRF) and Textual Entailment Suites (TES). After analyzing programmatically using Python programming Language, we found the results as follows: Accuracy rate of 0.606, 0.979, 0.973, 0.860, 0.965, 0.940 and 0.897 for Support Vector Machine (SVM), Linear Regression (LR), Naive Bayes (NB), Decision Tree (DT), Random Forest (RF), Recurrent Neural Network (RNN), Conditional Random Fields (CRF) and Textual Entailment Suites (TES) respectively. On taking the average we found the average value of accuracy on the structured data set to be 0.889.

Following is the comparison in (Table 1 and Graph) amongst two different approaches we already the accuracy rates for each algorithm vary significantly when consider the fact that input data is structured (average value of accuracy = 0.889) or unstructured (average value of accuracy = 0.753). Through this we came to the conclusion that if in the system of argumentation mining as a whole, we are able to increase the structural arrangement or in other words reduce the chaotic (unused) components of the data entered or fed to the AM system in its initial phase, we would be able to control the result or accuracy to a large extent in our favor. We iterated the above procedure i.e. the study of accuracy rates generated by several algorithms, Support Vector Machine (SVM), Linear Regression (LR), Naive Bayes (NB), Decision Tree (DT), Random Forest (RF), Recurrent Neural Network (RNN), Conditional Random Fields (CRF) and Textual Entailment Suites

S.No	Dataset 1	Dataset 2	Average
1	0.897	0.604	0.750
2	0.897	0.766	0.831
3	0.940	0.760	0.850
4	0.965	0.728	0.846
5	0.860	0.760	0.810
6	0.973	0.810	0.891
7	0.979	0.870	0.924
8	0.606	0.606	0.606
Avg	0.889	0.753	0.821

Table 1: Average Accuracy Rates on Structured and Un-Structured Data Set by : Support Vector Machine (SVM), Linear Regression (LR), Naive Bayes (NB), Decision Tree (DT),

Random Forest (RF), Recurrent Neural Network (RNN), Conditional Random Fields (CRF) and Textual Entailment Suites (TES)

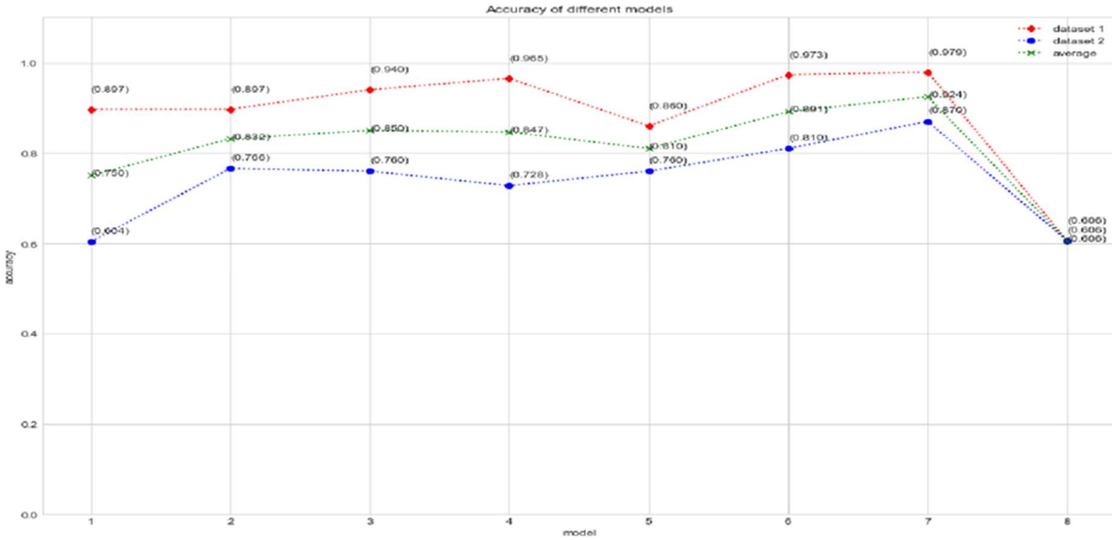

Figure 1: Comparative study of the models

4. Conclusion

Today, computational mathematics has made easier the sophisticated processing of data. In the digital world, all functioning of computer science is primarily the computational mathematics only. In this paper, we propose to resolve the problem of unstructured data through the computational mathematics. The worldwide data when put together as a single entity is quite dynamic in nature and constantly expanding. The proposed system consists of approximately 10% structured data in a specific format and likewise other 90% unstructured data is still not formatted, which is the focal problem in our consideration. A format here has been regarded as a pure form or preliminary stipulation of this system. Reducing complexity will have inverse effect in unstructured data mining, analysis, response and management processes. Further this methodology may be adopted by academia as well as related industries. This upon implementation might be a game changer in the field of data mining, storage, usability and all the related activities on Big Data.

REFERENCES

[1] J. Zhang, H. Huang, X. Wang, Resource provision algorithms in cloud computing: A survey, J. Netw. Comput. Appl. 64 (2016) 23□42. doi:10.1016/j.jnca.2015.12.018.

[2] C.M. de Farias, L. Pirmez, F.C. Delicato, W. Li, A.Y. Zomaya, J.N. de Souza, A scheduling algorithm for shared sensor and actuator networks, Int. Conf. Inf. Netw. 2013. (2013) 648□653. doi:10.1109/ICOIN.2013.6496703.

[3] R. Yu, Y. Zhang, S. Gjessing, W. Xia, K. Yang, Toward cloud-based vehicular networks with efficient resource management, IEEE Netw. 27 (2013) 48□55. doi:10.1109/MNET.2013.6616115.

[4] H.S. Narman, M.S. Hossain, M. Atiquzzaman, H. Shen, Scheduling internet of things applications in cloud computing, Ann. Telecommun. (2016). doi:10.1007/s12243-016-0527-6.

[5] C. Delgado, J.R. Gállego, M. Canales, J. Ortín, S. Bousnina, M. Cesana, On optimal resource allocation in virtual sensor networks, Ad Hoc Networks. 50 (2016) 23□40. doi:10.1016/j.adhoc.2016.04.004.

[6] D. Zeng, L. Gu, S. Guo, Z. Cheng, S. Yu, Joint Optimization of Task Scheduling and Image Placement in Fog Computing Supported Software-Defined Embedded System, IEEE Trans. Comput. PP (2016) 1□1.doi:10.1109/TC.2016.2536019.

[7] T. Dinh, Y. Kim, An Efficient Interactive Model for On-Demand Sensing-As-A-Servicesof Sensor-Cloud,Sensors. 16 (2016) 992. doi:10.3390/s16070992.

[8] M. Aazam, M. St-Hilaire, C.-H. Lung, I. Lambadaris, PRE-Fog: IoT trace based probabilistic resource estimation at Fog, in: 2016 13th IEEE Annu. Consum. Commun. Netw. Conf., IEEE, 2016: pp. 12□17. doi:10.1109/CCNC.2016.7444724. Y. Zhang, J. Chen, Constructing scalable