IEEE Computer Society India Council

Quarterly E-Newsletter

1st Oct, 2012

Message from chair

IEEE Computer Society Chapter India Council is bringing out the second issue of our quarterly newsletter. We had made a steady progress on various fronts.

- Our Conference/ Workshop team handled many sponsorship requests and guided them properly about the new rules/procedures to be followed for technical or financial sponsorship. It is to be noted that with new ICX process in place, it has become very smooth now.
- Industry outreach committee had very useful meetings in the last quarter and were able to brainstorm different ideas proposed. Now they have successfully made plans for next quarter and are planning to host few events in this connection
- We had started the process of interaction with ISTE to start some collaborative courses with ISTE, New Delhi. We plan to take it ahead in the next quarter.
- There have been discussions with people involved in "Indo US Collaboration for Engineering Education" regarding the mutual partnership on various issues. We hope to see some progress in the next quarter.
- Website developed by our team is doing very well and getting increased number of hits every day.
- Our volunteers have become very active on Facebook pages started by Computer Society India Council.
- Student Activity Committee is doing wonderful job. It had started a webinar series with the inaugural webinar of Mr. Rangachar Kasturi of Professor of Computer Science and Engineering, University of South Florida, USA.
- Women in computing team had successfully interacted with Grace Hopper Women in Computing Celebration team and a partnership is on the anvil.
- Membership Growth and sustainability committee circulated step by step procedure to start a new chapter in the institution and to become a member of computer society.

My congratulations to all the volunteers on the steady progress and I wish to strengthen the activities in the next quarter.

Dr Deepak Garg
(Chair IEEE Computer Society, India Council)

Complexity Theory: Exploring Computational Limits and Understanding the PCP Theorem

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We can see that a large number of complex algorithms are being converted into softwares and are being incorporated into large computer systems and supercomputing platforms, but how are these algorithms made efficient, how are they analyzed and what are being done to make their running times more practical ? Well, computational complexity theory is a vast field of computer science which has got the answers to the above mentioned questions for you. Let us have a brief understanding of the field and its implications on the field of algorithms.

So, what is complexity theory? We know that an efficient algorithm can be directly applied to solve a problem and is itself a proof of the solvability of the problem. But, the goal of complexity theory is to prove that hard and difficult problems cannot be solved with the amount of computational resources that we have. It shows the exact meaning of the efficiency of an algorithm, in terms of the amount of resources needed and the total amount of time spent to solve the problem with that particular algorithm. For example, let us suppose that we have got a problem *P* and two algorithms for solving the problem, *A* and *B*. Now, a deep analysis of the minimum amount of resources needed and the amount of running time for solving the problem using concepts of complexity theory can help us to determine which of the two algorithms can be applied? *A* may take two days to solve the problem, while *B* may take only an hour to solve the same, implying that *B* is much more efficient than *A* as far as runtimes are concerned. The main motive of complexity theory is to show that certain problems need certain minimum resources to get solved and this helps us to design more efficient algorithms to solve them. Results of complexity theory have many specific implications for the development of algorithms for practical applications. One of the problems is to find an algorithm, that given a provable mathematical statement efficiently finds the shortest proof for the statement and thus would be sufficient to solve all the hardest mathematical problems, including the Clay Millenium Problems. But much to our surprise, one of the Clay Millenium Problems is to find out whether such an algorithm exists or not and is known as the *P-NP* problem. *P* signifies the class of problems which has got very efficient algorithms to solve them and *NP* signifies the class of problems which can be easily verified in finite time. So, the question is whether the class of problems which can be efficiently solved is equal to the class of problems which can be easily verified. Here efficient algorithms signify the algorithms which have got polynomially bounded running times.

Let us see the mathematical definitions of the classes *P*, *NP* and some basic rules governing them.

Definition 1. *An algorithmic problem belongs to the complexity class P (polynomial time) of polynomially solvable problems if it can be solved by an algorithm with polynomial worst-case runtime.*

Definition 2. *A decision problem L belongs to the complexity class NP (nondeterministic polynomial time) if there is a nondeterministic algorithm with polynomially bounded worst case runtime that accepts every input* $x \in L$ *along at least one legal computation path and rejects every* $x \notin L$ *along every legal computation path. In other words, a language* $L \subseteq \{0,1\}^*$ *is in NP iff there is a polynomial time algorithm M and a polynomial p(.) such that for every* $x \in \{0,1\}^*$, $x \in L$ *iff there is a* $y \in \{0,1\}^{p(|x|)}$ *such that* $M(x,y) = 1$.

Now, let us see the meaning of reducibility of one problem to another.

Definition 3. *Let us fix languages $L_1, L_2 \subseteq \{0,1\}^*$. It can be said that L_1 polynomial time reduces to L_2 (expressed as $L_1 \leq_p L_2$) if there is a polynomial time computable function $f : \{0,1\}^* \rightarrow \{0,1\}^*$ such that for any $x \in L_1$ iff $f(x) \in L_2$.*

Definition 3 tell us that L_2 is at least as hard to solve as L_1 and thus means that, if there is a polynomial time algorithm for L_2 , there must be a for L_1 also. Many other problems can be reduced to the more familiar *NP* problems using some techniques and thus can be proved to be in *NP* or not using the above mentioned principle.

Definition 4. *A language L is NP-hard iff each $L' \in$ NP polynomial time reduces to L. If L is NP- hard and also happens to belong to NP, then it can be clearly said that L is NP complete.*

The great works of Cook, Levin and Karp in the 1970s helped to show that famous problems like Satisfiability, Vertex Cover, Travelling Salesperson Problem and MaxCut are all **NP Complete Problems** and since then, the journey of NP Completeness Theory and reduction of many problems to NP complete problems had begun and is still at its full force**.** Beautiful and extensive research in the field of approximation algorithms in the previous 20 to 30 years has led to great results for several of the NP hard and NP complete problems. However, it is very difficult or almost impossible to explain all the different approximabilities of different NP hard problems, though the theory of NP completeness provides many answers to algorithmic hardness in many ways. But, in the early 90's mathematicians and computer scientists came up with a beautiful and very complicated theory known as the PCP theorem which would change the field of theoretical computer science forever and helped greatly in shedding light on the limitations to the approximation algorithms and the monstrous P-NP problem. PCP stands for Probabilistically Checkable Proofs and the theorem is just a very simple statement. It states that every mathematical proof can be written in a format that can be checked probabilistically by reading only two statements independent of the number of statements in the proof. At a first glance it looks completely unbelievable and awkward and seems to be way off and completely unrelated to the discussion, but the sheer mathematical beauty and compelling elegance and complexity of the theorem has already broken many barriers and gave birth to many new results and deep understanding of the field. But, the proofs that we know are sequential, where one proposition comes from the previous one. It is quite possible that only one transition or one statement be false for the whole proof to be false. So, the question was, are there proofs that are not sequential and consist of many local tests, without apparent order between them? In the 1980s, extensive research on the topics of Interactive Proofs and Multi-Prover Interactive Proofs helped to create this above mentioned notion of probabilistic checking of proofs, proofs that can be checked locally by reading only a constant number of their symbols.

In a normal proof system of *n* statements, each statement comes from the result and implications of the previous statement and the correctness of the statement is completely dependent on the previous. To check the correctness of the last statement in the proof, we need to follow the reasoning statement by statement and if any one of the implications becomes false, then the final statement becomes false. But, in the format of the current proof system, many statements can imply the same statement and thus makes robustness, and hence probabilistic analysis possible. Now, for a correct proof the first statement must imply the second, but if the bottom line of the proof is false, then there will almost be no implication that will hold because no reasoning is possible in this case. Consequently, the probability that the second statement is being implied by the first is low. It was found out that probabilistic checking is equivalent to hardness of approximation and this connection made the mathematicians to ponder upon whether NP has PCPs or not and ultimately led to the PCP theorem. The PCP theorem, its implications and the strong form of the theorem are all mentioned below mathematically.

Theorem 1. $NP \subseteq PCP_{1,\frac{1}{2}}[O(\log n), O(1)]$ *(The PCP theorem)*

These are the following implications of the following theorem.

1. *We have a fixed s < 1 and a fixed alphabet Σ, such that* $NP \subseteq PCP_{1,s}[O(\log n), 2]_{\Sigma}$.(It has only two queries and is the two query PCP theorem)
2. *For any fixed* $\epsilon > 0$*, there exists a query function f, where f = f(*ϵ*), such that* $NP \subseteq PCP_{1,\epsilon}[O(\log n), f]$.(It is the low error version of the PCP theorem)

The following mathematical statement shows the strong form of the PCP theorem, in which it is possible to achieve two queries and low error simultaneously. Almost all the optimal hardness of approximation can be analyzed with the help of this theorem, also known as the Strong PCP Theorem.

Theorem 2. *For any fixed* $\epsilon > 0$*, we have an alphabet Σ, whose size is dependent on the value of* ϵ*, such that* $NP \subseteq PCP_{1,\epsilon}[O(\log n), 2]_{\Sigma}$ *. (The Strong PCP Theorem)*

Thus, we had some basic understanding of complexity theory and the elegant PCP theorem, but the field of theoretical computer science is so vast that it will take a great deal of time to understand the central problems completely.

Some of the general and broad questions, which according to me will consume a vast part of the research of mathematicians, computer scientists and philosophers in the near future have been listed below. These broad questions may well compete with other monstrous problems from Algebraic Geometry, Topology or Number Theory to be one of the toughest unsolved challenges in mathematics.

1. Professor Ludwig Van Wittgenstein, one of the greatest philosophers born in the history of mankind, claimed in his book *Tractacus Logico Philosophicus,* that we should not ponder upon any such thing which is not true and cannot be spoken about and try to avoid it in our analyses. We should be completely silent in that case. We do not know the truth that whether P is equal to or not equal to NP and must not speak about it and thus should not assume P ≠ NP for our analyses, as the result which we will get will not be the ultimate truth according to Wittgenstein. But, many philosophers believe that mathematics is the ultimate form of truth. So, if we have some strong mathematical reasons to assume P ≠ NP and thus, assume it in our analyses and finally deduce all the conclusions using the assumption, we will get mathematically correct results, which according to other philosophers will be the complete truth about the analyses. Now, the main question is upto what limit can the mathematical reasons be strong enough to assume P ≠ NP and not contradict any philosophical laws? Is it possible to define a unified theory of both mathematics and philosophy, so that assuming P ≠ NP becomes feasible and finally we have the solution or should we directly try to go for a proof without assuming heavily, which may contradict Wittgenstein's law and try to find a detailed mathematical analysis ? Let us assume that a philosopher proves P = NP philosophically and a mathematician proves that P ≠ NP mathematically or vice-versa and both of them use very strong foundations of mathematics and philosophy, then which proof must be accepted, the mathematical or the philosophical one ? If one of the proofs becomes accepted, then should we refute the other one since it has also got very strong foundations of either mathematics or philosophy ? Again, a day may come when we may get P = NP both mathematically and philosophically, then what will happen to all those conclusions that were achieved by assuming P ≠ NP ? And finally, at last if we have a proof P ≠ NP both mathematically and philosophically proven strongly, then which proof should be accepted (the other can't be rejected since it has also got very strong foundations) or should a proof be developed by combining both of them, so that they are both mathematically sound and philosophically true ?

2. Is there any chance of deciding the approximability of a certain problem and know beforehand, whether deciding that there exists an approximation algorithm for the problem is NP complete or not, with the help of the PCP Theorem ? Moreover, can the PCP theorem help to somehow connect

quantum computation with the Church-Turing thesis, though the former completely violates the latter.

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Important News:

The IEEE Rural Mobile Technology Initiative website has been officially launched (Led by Mr. Sampath). An Industry symposium focusing on "Computing, Policies and Initiatives for Healthcare IT" is planned to focus on RMTI at the 9th ICDCIT Conference next February. We welcome industry and academic participants to the RMTI initiative and to participate in the industry symposium at ICDCIT. For more information, people can reach the committee through Srini Ramaswamy.

www.ieee.org/go/rural

The IEEE Rural Mobile Technology Initiative (RMTI) is an advisory think-tank enabling mobile technology, collaborative execution, and standards in improving life for rural and Below-Poverty-Line segments in India and beyond.

RMTI serves as a platform for effective processes, procedures and technology convergence with participation from professional associations, governments, corporates, universities, foundations, NGOs and global institutions. Applications span authentication, mobile money, employment, training, entrepreneurship, economic development, mHealth, mEducation, and mGovernance.

Testing the Accuracy of the Decision tree analysis using INTRA College Festival Data

Dr. Sumit Srivastava
Secretary, EXECOM, IEEE CS IC

For the extraction of large data sets with the combination of statistics, DBMS and Soft Computing Approach, Business Intelligence and Business Analytics are becoming important tool in the market. But with such advancement the accuracy of the model under studied, processed via different server is always questionable. For the conviction of our idea, we have processed a classification[2] & fuzzy based[3] approach on the Intra College Festival Data. The application data set consists of the cultural fest organized as annual fest in one of the private engineering colleges. It includes nearly 22 technical events, 13 club events, 7-8 sports events, 9-10 cultural events with 5500 approx. student participating for the competition. For each student participation in activity involving Technical and club is a must with total of 4 events per student has to be submitted. So with almost 5500*4= 22,000 entries as input the event has been successfully completed. During the result analysis, it was asked to predict the participation in each types of events by each branch of each college with Gender of the students can be as the dependent variable for the analysis. Also if the event is supposed to a group then classification of the information on the basis of college, year, branch, team-name, event-name is requested. For such problem CHAID as Decision Tree Algorithm[1] is selected as the best technique for the solution as information can be branched using non-binary variable. The reason of choosing binary trees as solution is as follows

1. Decision trees are white boxes means they generate simple, understandable rules
2. Decision trees are non-parametric means no specific data distribution is necessary.
3. Decision trees handle missing values as easily as any normal value of the variable.
4. In decision trees elegant tweaking is possible.
5. Decision trees identify subgroups. Each terminal or intermediate leave in a decision tree can be seen as a subgroup/segment of your population.
6. Decision trees run fast even with lots of observations and variables
7. Decision trees can be used for supervised and unsupervised learning.
8. Decision trees can easily handle unbalanced datasets.
9. Versatility for a wide variety of data mining tasks, such as classification, regression, clustering and feature selection

The application has been tested on various software's' like SPSS18.0, WEKA & Rapid Miner.

The snapshot of the same can be seen below in Fig 1 & Fig 2. It has been seen that the accuracy of models differ in terms of the missing value treatments. For particular software like SPSS it has been included as a classification with one of the leaf nodes while they are treated separately in case of WEKA as a Software. Also the accuracy measure in terms of means square value and the calculated Chi-Square value. But again information Missing measure is more profound in CHAID in SPSS as compare to J48 being used in WEKA. So the measure of parameter under study greatly affected by the type of Software used for predicting the output

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On Biometrics - The Technology behind “Aadhaar” by Mr. Rangachar Kasthuri

The IEEE Computer Society SAC webinar series has successfully launched by the inaugural webinar on Biometrics – the technology behind “Aadhaar” by Mr. Rangachar Kasthuri of Professor of Computer Science and Engineering University Of South Florida, USA.

The session started as per the scheduled time that introduced the students into a new learning experience. The technical moderators of the webinar were Mr. Vishnu Sanker and Mr. Rajmohan Pardeshi, members of The IEEE Computer Society SAC Team.

The webinar started with introducing the students to biometrics from the basics. It then advanced to topics like pattern Recognition, Biometrics modalities, Biometrics Challenges, India’s Unique ID Initiative, Biometrics System errors, Security, Facts about Aadhaar. The participants got a better understanding about the technology behind Aadhaar. The webinar scheduled for an hour was extended for half an hour as per the request of participants.

The feedback the team received was over-whelming and inspirational to the team. The students thanked the speaker, and asked the IEEE Computer Society SAC Webinar team to come up with more number of speakers. The session was recorded and will soon be made available on IEEE e-learning portal.

About the Speaker

Dr. Kasturi is the Douglas W. Hood Professor of Computer Science and Engineering at the University of South Florida. He received his Ph.D. degree from Texas Tech University in 1982. He was a Professor of Computer Science and Engineering and Electrical Engineering at the Pennsylvania State University during 1982-2003. Dr. Kasturi served as the President of the International Association for Pattern Recognition (IAPR) during 2002-04 and as the President of the IEEE Computer Society during 2008. He is a Fellow of the IEEE and a Fellow of IAPR. He was a Fulbright scholar during 1999 Applications journals. Sponsored projects on computer vision based collision.

Vishnu Sanker.M (vishnusanker@computer.org)
Webinar Lead||IEEE Computer Society SAC Team

IEEE-India Council Computer Society MGSC Meeting Minutes

- Send out Computer Society Membership Development Resources (Ppts, chapter petitions, payment procedures) to all active Student Branches across India.
- Design a Power Point Presentation portraying the benefits of joining IEEE Computer Society specifically aimed at IEEE Student Members of India Council, within one week's time.
- Decided to celebrate CS Chapter Day in different sections, hosted by leading Student Branch. Chapters, with delegates from all student Branches across the respective sections. Active CS Volunteers could present the benefits of becoming Computer Society members and guide the interested volunteers to initiate CS Chapters in their Student Branches.
- First instance of Chapter Day to be conducted in the Kerala Section in the month of October, with Richard E. Merwin Scholars from Kerala Section in the lead.
- To delegate active volunteers from CS IC committees to coordinate Chapter Day activities in their respective Sections.
- To put up a stall of IEEE MGS Committee at All India Student Congress to be held at Bangalore on 28th, 29th and 30th of September, interact directly with leading Student Branch Volunteers and promote CS Memberships.
- To plan for activities of MGSC Committee to be conducted during CS All India Student Congress, to be held at Rajagiri School of Science and Technology, Cochin on 8th of December.
- To discuss with the Student Activities Committee, the prospect of conducting online White Paper Submission Competition/ Online Conference, for student members.

Akshay: Chair of Membership Sustainability and Growth Committee has been selected as the "Larry K Wilson Award Winner" for 2012 from Region 10. It is given to only one volunteer from a region who have shown significant achievements and impact to the whole student community.

Please see: http://www.ieee.org/membership_services/membership/students/awards/larrykwilson.html

And also he have been recently awarded with IEEE Computer Society Richard E Mervin Scholarship : http://www.computer.org/portal/web/studentactivities/2012AprMerwinWinners
Congratulations to Akshay Menon. It shows the leadership credentials of our volunteers.

Few Other Computer Society Members from India have also received the same award. Kudos to all of them.

1. To startup a webinar series in trending topics in Computer Science
2. To create a Video Library of IEEE Spectrum talks and recent trends in Computer Science.
3. To help and assist student branches in forming a student branch chapter.
4. To have an initiative in Humanitarian projects were Computer Society can play its role. (With IEEE SIGHT)
5. To assist Developers via providing guidance and professional assistance.
6. A National Level Treasure Hunting Game including the technical loops in computer related field.
7. To conduct a MiniXtreme (Coding event) in National Level.
8. To conduct a National Level Student Conference. (After discussing with Conference Committee)
9. To create a showcase for Free Computer Related Tutorials.
10. To assist Women In Computing Committee for activities in Student level.
11. To bring up healthy discussions and new initiative via Facebook groups.

Bibin Mathew Joseph: Chair of Student Activity Committee is chosen as one of the Google Ambassador of the year.

This is one of the examples that how our volunteer will shine. Happy Volunteerism!

Kindly send us your valuable feedback on this issue to Newsletter Team at our e-mail id

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New team will be in place for the next year, So Next newsletter will come on Feb 1st, 2013.

For Computer Society Membership Benefits Visit:
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