Role of Computer Science development in India - A Review

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Abstract: This paper outlines the nature of computer science research in India. It has been divided into five sections. Section one mainly focuses on the type of institutions in which computer science research is conducted, followed by a glimpse of the students and faculty at the educational institutions. Support available for conducting research in the form of equipment, infrastructure, and publications, is given in section 2 .Section 3 covers the major Industrial labs which have attracted global attention, the funding agencies, lacunas which computer science research suffers from and the reasons for that is also discussed in this section. Section 4 presents type of Computer science research in India, Infrastructure available .Section 5 gives an overview of ICTs and their role in development, particularly in the context of millennium development goals (MDGs). Details select ICTs innovations of India in achieving MDGs. Further, it lists out India's position in relation to MDGs by highlighting India's target, current status and steps taken to achieve them .section 6 includes the contribution of software to India's economic development paying particular attention to the role of the software in the absorption of labour and the development of human capital in the Indian economy.

Keywords: MDG-millenium development goals,ICT,ERNET,NICNET,NMEICT,TRDDC,SPIC, ERNET, TIFR, NAL, BARC.

INTRODUCTION

Information is the key to democracy. Information empowerment is fundamental to a successful democracy. The advent of computer science research has nurtured the swift emergence of a global ''information society'' that is changing the way people live, learn, work and relate. Computer Science (CS) research in India started in earnest only in the mid-80's, further propelled by the establishment of post-graduate programs in many institutions throughout the country at that time. Today, almost all areas of computer science research are covered by researchers in India, including topics that are "hot" elsewhere such as multi-media, workflow automation, virtual reality, and hardware-software co-design.

Section 1- The institutions in India are categorized as:

1.Educational Institutions
2.Government sponsored Research organizations
3.Private Research organizations.

Educational Institutions include seven IIT's and IISC located in Bangalore.The next tier of institutions is made up of NIT's ,one located in each state.

Computer science research is carried out at various departments at IISC which includes design and analysis of algorithms, Graph theory, computational geometry and computational number theory. Some scientists have research area as computational biology,generating 3-d Structures directly rather than constructing it as layers of 2-D shapes.CAD-CAM research.Research is also going on in theareas of DataBase systems,Real Time Systems, concurrency control protocols.Apart from these some scientists are involved in theoretical computer science ,software engineering [2]IIT Bombay is the premier institute where research is mainly carried out in the area of Compilers,they are working on Parallelizing Compilers.

The next tier includes institutions including NIT's where each is located in each state.Apartthere are several other universities where research is carried out, one such is University of Hyderabad.Here research is carried out in (Collaborative)AI.Althoug there exists a considerable gap between the premier institutes and the next tier because of the high load imposed n Faculty.

Section 1.1
US and Europe have a very high regard for graduate students trained at the IITs and in IISc. Due to the reason that dmission to the Bachelors' program (called B.Tech) at the IITs is through a fiercely competitive entrance examination called the Joint Entrance Examination (JEE).

It is written by over 100,000 students every year, with less than 1500 selected -- based purely on their ranking in the JEE. The curriculum at the IITs is on par with top institutions in developed countries. An importantbench mark in this regard is because the students in Final Year have to undergo a which is quite ambitious where students go and publish their valuable work in conferences and journals.

All the academic research institutions have a Masters' program (called M.Tech), students selected once again after a competitive examination called GATE, perhaps not quite as competitive as JEE. M.Tech's come (more often than not) from a non-IIT background and their preparedness in computer science though is not up to the mark but with their hard work they make up to the level of IIT's.

Some institutions have a master's program called M.S.(Master of Science) which is purely research project oriented ,but this program is not present in all Institutions.

Section 2

Government Sponsored Institutions, Industrial Labs.

These institutions are funded by different government ministries and departments.

TIFR and the Institute for Mathematical Sciences (MatScience) perform research which is predominantly of a theoretical nature. These are funded by DAE. Other Institutions where Defence related work is carried out includes a number of labs in the country,A good example is CAIR which can be described as a "think- tank" serving the AI and robotics needs of Indian Ministry of Defense. It is a component of the Defense Research and Development Organization (DRDO).

The Ministry of Planning funds ISI, with its primary location in Calcutta. (the first indigenous digital computer -- fabricated using discrete transistor units -- was commissioned by ISI in 1966 in collaboration with Jadavpur University.)[2]

Other Sponsored institutions include National Aerospace Laboratories (NAL), Bhabha Atomic Research Center (BARC), and Center for the Development of Advanced Computation (CDAC) have had the development of parallel processing platforms for solving computational science problems as the main focus of their computer science research .

Section 3

Industrial Labs:

Tata Research Development and Design Center (TRDDC), supported by the Tata group of companies, and the SPIC science foundation (SSF), sponsored by SPIC, a petrochemical corporation, are good examples.

While the latter is primarily involved in theoretical computer science research, TRDDC is geared up to "result-oriented research" to meet the needs of Tata Consultancy Services (TCS) and its clients, and more generally, the Tata group of companies .TRDDC is unique as it takes self-supporting R&D effort. Even though most of the projects are done for TCS, TRDDC also has funds from DST, MoD, and other government organization.

CS research in India is funded primarily by All India Council for Technical Education (AICTE), Department of Science and Technology (DST), Department of Electronics (DoE), Department of Atomic Energy (DAE), Ministry of Defence (MoD), and Department of Space (DoS). These are responsible for more than 80% of scientific R&D funding ["Technology in India"]. India has over 1100 R&D institutions but just a little over US$800 Million is spent on them annually. This is a meager 0.89% of its GDP (down from 1.1% of GDP just three years back). It is not surprising that research funds for computer science are also scarce[1].

This is summarize in Table 1 given below

SNO	Areas of Computer Science Development	
	Areas	Institutes Involved
1	Design and analysis of algorithms	IISC,all IIT's
2	Graph theory	IISC
3	computational geometry and computational number theory	IISC
4	DataBase systems	IISC
5	Real Time Systems	IISC
6	CAD CAM Design	IISC
7	Theoretical computer science ,	IISC
8	Software engineering	IISC
9	Compilers,Parallelizing Compilers	IIT Bombay
10	AI	University of Hyderabad
11	Parallel processing platforms	cdac
12	Theoretical computer science research	TRDDC

Section 4

Type of Computer science research in India

Many computer science researchers in India have endeavored to carry out high caliber research in spite of limited infrastructure and resources to conduct and communicate their research. Many of the researchers are involved in collaborative activities with institutions abroad, primarily in the US.

Section 4.1

Research equipment and Infrastructure:

To begin with a charter to provide a state of the art computing facility, the Supercomputing Education and Research Center (SERC) at IISc today boasts of a computing environment that is one of the best in the world. This environment consists of several latest types of workstations, parallel processors, and supporting infrastructure, and serves the needs of researchers at IISc as well as the country at large. Even the IITs also to a large extent boost of having state of art laboratories for their researchers and the major research laboratories, such as CAIR and TIFR, are well endowed in terms of number and type of equipments.

Thanks to ERNET, ERNET India is the National Research and Education Network dedicated to support the needs of the research and education community within the country.[4] India's researchers have access to Usenet bulletin boards and to public domain software, in addition to being able to communicate with their colleagues through e-mail. Eight nodes form its backbone -- the five IITs, the IISc, NCST, and DoE. Funding for ERNET was provided by the United Nations Development Program (UNDP) with matching funds from DoE.

Another network, NICNET, is satellite-based and spans the country but has been designed to cater to the needs of the government. NICNET connects the nation's capital

with the capitals of the states and the headquarters of the over 500 districts. NICNET was developed by NIC(National Informatics centre a government body which was set up in 1975). bring the benefits of information technology and networking to help this nation, most of whose people live in villages. NIC helps the government collect information of various types, from weather to crop yields. NIC helps the government collect information of various types, from weather to crop yields. But ERNET and NICNER are not interrelated so information can't be accessed through ERNET that is made available through NICNER.

Section 5

Information and Communication Technology

Even after 60 years of India's independence, the most pressing problem for the country is still how to deal with its rural poor. Out of 1027 million people, 742 million (72.2%) live in rural areas and 285 million (27.8%) in urban areas. To address this problem of rural areas where agriculture plays a vital role in the growth, employment generation, and contributes a quarter of national income. ICTs denote a wide range of services, applications and technologies, using various types of hardware and software. The applications cover video conferencing, distance learning, management information systems (MIS), stocktaking, etc. The technologies range from old technologies such as radio and TV to new ones such as cellular mobile communications; networks may be comprised of copper or fibre optic cable, wireless or cellular mobile links, satellite links, etc. ICTs involve more hybrid advancements (tele and video conferencing, multitask devices, other wireless systems) and at the same time traditional devices also.

The importance of ICTs is not the technology as such, but it enables facilitating enhanced access to information and communication across large distances; improved access to governmental; opportunities to trade or bank online through kiosks; new opportunities to design, manufacture and market products through internet or intranet systems; enhance knowledge by learning online increased and improved education through computers or about computers or both; superior medical advice and diagnostic information; information about local resources, opportunities to earn a better living by learning a new skill in the knowledge-based economy, improving agricultural productivity, etc examples include IIT's initiative empowerment of teachers and students through synchronous and asynchronous instruction under National Mission ,under which they aim to train T10KT teachers and students world wide under special courses in various branches of engineering and technology ,health sector is another example where ICT plays a vital role.

Section 5.1

ICT in health

e ICTs innovations that are being developed from various agencies play a lead role in reducing the incidence of HIV/AIDS,(as India has become the second largest country among South Asian countries where people die

due to HIV/AIDS every year),malaria and other major diseases or help those affected by way of enhanced in-service training for health workers, increased access to remote diagnosis, monitoring, information sharing on diseases, etc.

Action against HIV/AIDS was the first step taken in INDIA by non profit organizations to bridge information, networking and other capacity gaps through three main avenues: (i) in 2000, it had started a listserv saathii@yahoogroups.com to address the need for timely information delivery covering current advances in scientific and clinical aspects of HIV/AIDS, advocacy, contributions to programme development by connecting implementing and funding agencies with each other, etc., (ii) in 2003, it brought out the first national HIV/AIDS directory developed for India on online mode as SAATHII Red Ribbon Pages 2003 (http://www.saathii.org/stapps/searchIndex.jsp).

Health internetwork (HIN) India was launched by the World Health Organization (WHO) and the United Nations Development Program, in 2000, to narrow the digital divide in health.

CONCLUSION

Many computer science researchers in India have endeavored to carry out high caliber research in spite of limited infrastructure and resources to conduct and communicate their research.Many researchers are involved with organizations abroad,mainly in US.Studies have been carried out to do analysis and check the trends of computer science development in India.It has been found that india is at par with other developed countries due to the areas in which research is carried out here in premier institutions,the kind of intellect produced which has high demand in US markets.The major lacking factor which researchers feel is the limited infrastructure and resources which if provided can propel the industry researched to give better results.

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