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IIT KGP RESEARCHER

CATALYSING CORPORATE CONSCIENCE

CSR Projects at IIT-KGP

creating responsible citizens and a healthier nation

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&
GENDER EQUALITY
AND WOMEN EMPOWERMENT

HUNGER, POVERTY,
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IIT-KGP RESEARCHER
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DEDICATED TO THE SERVICE OF THE NATION

My heartiest congratulations to Team-Researchers for the success of the first issue.

Researchers at KGP have been dedicated towards evolving the lives of people in various ways for more than 60 years. Innovations in areas of rural development, medical sciences, food sustainability, education and many more have been brought about by efficient and impactful solutions.

Our corporate counterparts are committed to contribute towards sustainable economic development by working with all stakeholders, for societal development in ways that are good for business and for development.

KGP aims to be a catalytic agent facilitating corporate citizens in realization and development of sustainable and transparent Corporate Social Responsibility projects. It brings researchers and corporates under the same umbrella, creating responsible citizens and a healthier nation.

We hope this issue of IIT-KGP Researcher magazine will provide an integrated platform for corporations and researchers to compliment each other.

PROF. PARTHA PRATIM CHAKRABARTI,

DIRECTOR , IIT KHARAGPUR

MESSAGE FROM EDITOR

Dear Readers!

We are happy to introduce the second issue of 'IIT KGP Researcher'.

Businesses are economic power-banks of a nation with the capacity to bring transformational changes in development and growth of necessitous section of the society.

Researchers at IIT KGP are involved in creating innovative developmental models and deployable cost-effective solutions aimed at creating a healthier society and greener planet. This issue will be focused at providing solutions to our corporate readers from a TBL (Triple Bottom Line) standpoint.

Team Researcher is dedicated to incessantly evolving with time. Your inputs and ideas are essential in fulfillment of our objective.

Hope you all enjoy reading this issue as well.

PROF. SIDDHARTHA MUKHOPADHYAY

DEAN, AA & IR PROFESSOR, ELECTRICAL ENGINEERING.

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TECHNOLOGY ENABLED EDUCATION - IMPORTANCE AND POSSIBILITIES

ANUPAM BASU

The interplay between technology and the teaching-learning process is not a recent phenomenon. The technology of writing on palm leaves to preserve knowledge was known to our predecessors. We have all grown up in the era of chalk and slate technology that provided effective learning platforms, much before the days of "smart class rooms". The recent advent of Information and Communication Technology (ICT) has multiplied the opportunities of delivery of information and knowledge, making it globally accessible and is now playing a key role in shaping the Teaching-Learning process as well as in extending the reach of education to all segments of the society.

ICT has enabled the on-line courses, which can be offered in synchronous as well as in the asynchronous mode. While the NPTEL (National Program on Technology Enhanced Learning) program is an example of the latter, the MOOC (Massive Open On-Line Courses) courses, and the Live on-line courses are examples of the former. The NPTEL program was initiated by the Ministry of Human Resource Development, with the objective of meeting the paucity of experienced teachers in many engineering colleges and institutions. Lectures in the form of video and supplementary lecture materials in the form of web documents have been prepared and have been made available in the Video on Demand mode, to engineering students across the country. IIT Kharagpur has contributed more than 100 courses to the NPTEL repertoire, which is being accessed by engineering students across the globe.

Recently, MOOC compliant NPTEL courses are being offered, also through MHRD sponsored program. These courses will run in the synchronous mode (video lectures being multicast at pre-specified times), with supplementary interactions in the batch mode. Attendees of these courses can opt to be evaluated, in order to obtain course clearance certificates. IIT Kharagpur is an integral part of this endeavor, where it is going on-line with a number of courses in a phased manner. Besides, the courses through Couresera, Khan Academy etc. are well known.

THE SCHOOL LEVEL FOUNDATION:

It may however be pertinent to point out that the above mentioned initiatives are all focused at the Higher Education segment, and at Engineering education, in particular, though efforts on development of on-line course materials in line with the NCERT contents, has also taken off. Given the fact that many of students of the primary and secondary schools do not have access to good and inspiring teachers and attractive as well as effective learning materials, the number of drop outs are increasing on one side and the quest for knowledge is also drying out among a large section of the school students. In this perspective, ICT can play a major role in reaching out to school students with rich, attractive and effective contents. Efforts to this end has already been initiated.

One major requirement and challenge in the area of School education is development of contents in the local language, though there are conflicting views against this statement. Since, higher education is mostly in English, and also as English serves as the link language, the necessity of teaching English cannot be undermined. A possible solution could be to have a variety of contents in a "Blended Language", where explanations in local languages are interspersed and

a mix of English and local language is used, with English technical terms and definitions. This model has been found very effective among a few pilot rural schools.

While the schools can include ICT enabled delivery of contents in the school hours, it is also possible to adopt these as a supplement to what is being discussed in class.

The Teaching-Learning Center (TLC) being initiated at the Center for Educational Technology, IIT Kharagpur has ICT enabled School Education as a major vertical activity to enable adoption of different pedagogies in school education. Another very important vertical is Second Language (English) Acquisition by Indian students, where the hot-spots of L2 learning will be identified through deep data analytics and intervention suggestions will be issued. Extensive data collection activity, across demographic variations, has been undertaken for analysis.

ONE SIZE FITS ALL?

The Teaching-Learning process has been traditionally teacher centric, where the students mostly act as the receivers of information, and possibly internalize the information and knowledge packets received through their individual cognitive processes. Even in this traditional mode, the teachers could adapt their delivery, explanations and modes, to personalize the process according to the needs of the individual students, for low student-teacher ratio. For large classrooms and for on-line delivery of courses, such feedback loops turn out to be very thin and practically non-existent. At best queries are answered either in batch mode or in asynchronous mode. Yet, the real flavor of "affective" teaching-learning is missed out.

Depending on the abilities and learning styles of the individual students, different modes of teaching learning may be effective. Accordingly, different "pedagogies" needs to be adopted for personalizing the teaching-learning process. The same "knowledge component" may be presented through different pedagogic styles, such as games, argumentations, problem-driven, example-driven, narratives etc., and accordingly different digital contents

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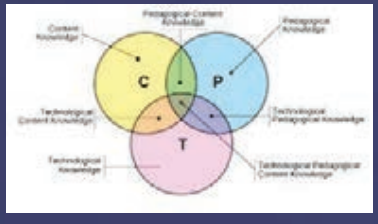
can be prepared for the same "knowledge component" or topic. In many cases, Flipped mode of teaching (where the students go through the Learning Objects earlier, and in the class problems and discussions are encouraged), Learning by Doing have served as very effective pedagogy. Accordingly, the a variety of Learning Objects can be prepared, even for the same "topic to be learnt" and this variety of contents leads to a rich on-line repository, which can be suitably indexed for on-line access.

The TPCK (Technology, Pedagogy, Content Knowledge) model depicted in Fig.1, brings in the additional role of Technology and its interaction with the Content Knowledge and Pedagogy Knowledge, discussed above. Depending on the technology adopted for delivery of on-line contents, the pedagogy as well as the organization of the contents need to be tailored for its effectiveness. Along with the recent spur of research in this direction, IIT Kharagpur has also delved into the enquiry of this aspect to make the technology enabled learning process more effective.



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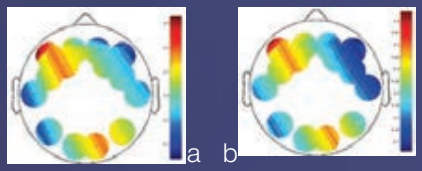
AFFECTIVE TEACHING-LEARNING:

A real "affective" teaching learning process must take into account the psychological and cognitive states of the individual students and should adapt accordingly. Several cognitive parameters, such as Attention Span, Short Term Memory, Reasoning Prowess, Ability to Integrate information, Comprehension and Expression ability, plays very important roles in the learning process. These parameters vary with students and are also evolving and dynamic. The contents presented to a reader pose different cognitive demands to the users, in respect to their memory. This is known as "cognitive load". Similarly, for better comprehension, the "attention capacity" devoted to the task, should meet a particular threshold.

The present state of ICT allows capturing the cognitive behavior of a student, through different technological means. Deployment of Eye-Trackers allows keeping note of the saccade while a student reads an on-line content. It can also be used to identify the "stumbling blocks", during the reading process. The data acquired from Eye Trackers can also be used to track the attention of the student at real time. The EEG data can indicate the "memory load" or the "cognitive load" that is being posed to a student during a task (Fig.2). Individual as well as category-wise student models can be constructed with the help of such data and the on-line contents can also be annotated with such "cognitive load" metadata. Psychological stress can also be traced using low cost devices, such as Galvanic Surface Resistance meters etc. Application Program Interfaces are also being designed to capture the navigation behavior of the students accessing on-line contents.



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Channel Discrimination Map for (a) Alpha and (b) Theta Activation of Scalp EEG Signals

The information, thus obtained as feedback, can be analyzed and adaptations in pedagogy, with respect to presentation of the learning objects from the repository, adoption of new pedagogy can be resorted to for providing a more sensitive and affective teaching-learning environment. Such research has been undertaken at the Center for Educational Technology, in collaboration with industry partners.

EVALUATION AND ASSESSMENT:

The Test-ware is as important as the Course-ware in the teaching-learning process. Education psychology researchers have long presented us with the cognitive taxonomy of learning, which spans through the cognitive abilities of Recall, Understanding, Application, Analysis, Evaluation and Creativity. Just as different segments of the course material stimulates the different layers of this taxonomy, the evaluation and assessment process must be so designed so that the different layers are individually tested. This will enable providing a more balanced judgment of the "ability" of a student, rather than a gross figure obtained through summative assessments. A balanced "test" and evaluation will further provide cues to the aspects that need to be dressed up better. Using ICT (Natural Language Processing technology), automated analysis of "question papers" with respect to their balance, in regard to the cognitive categories has been undertaken here, with the objective of providing feedback to the question setters. Natural Language Processing (NLP) is also being used to develop systems for automatic grading of short answers, thus liberating the evaluation from being restricted to multiple-choice questions only, due to the large volume of candidates.

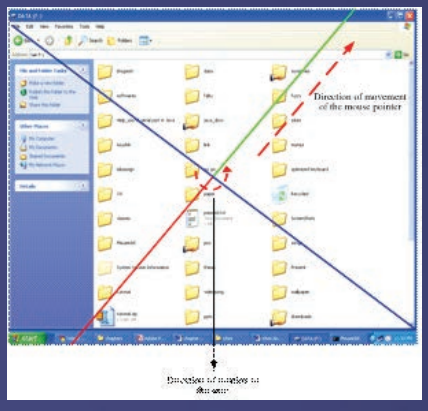
EDUCATION FOR THE MARGINALIZED:

Besides the endeavor to reach out to the rural students, through on-line delivery of "blended language"

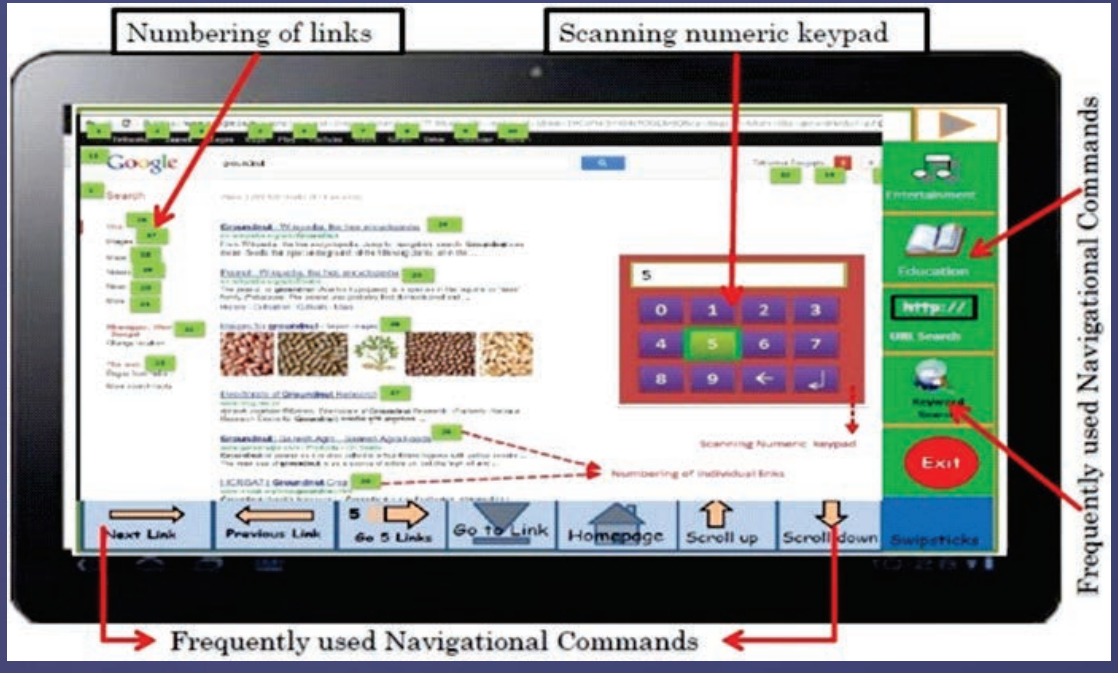
contents, technology can be very effectively used for providing educational support to the physically challenged. A few of the technology initiatives, undertaken at IIT Kharagpur is being cited here as examples.

The Sparsha software, can transliterate any Indian language content as well as English content in Braille, which can be embossed on any Braille embosser. This software, thus facilitates production of Braille books at ease. The sightless students need to take the help of "writers" to write the tests. The writers should be of lower grade student than the candidate. Also, often it is difficult to get writers. A Speech-Enabled Keyboard has been designed, which enables the blind students to write in local language as well as in English, seamlessly and get the speech feedback of the text that (s)he writes. Thus, the students can be self reliant in taking notes and for writing tests.

In order to enable the neuro-motor disordered students access the computer as well as for accessing the web, several special devices and interfaces have been designed. These include special access switches (Fig. 3) and Sweep-Sticks (Fig. 4), a special access mechanism that allows the "mouse and keyboard disabled" navigate the conventional user interfaces, albeit with reduced speed. Specialised Human-Computer-Interface (Fig. 5) has been designed for educational web access as well as for social network participation by the neuro-motor disabled students, such as those with orthopedic impairments or with cerebral palsy. A novel icon-based system, christened "Sanyog" is also in use in several schools. This system allows the motor impaired and speech impaired students to express themselves through selection of icons. The system automatically forms the correct sentence and pronounces it through an in-built text to speech system.



Channel Discrimination Map for (a) Alpha and (b) Theta Activation of Scalp EEG Signals



Special Web-Browser for the Neuro-Motor Disabled

All the above technology and tools help in making "inclusive education" a reality. However, in order to reach the grassroots, that is the segment for whom these are meant, the pilot deployments carried out so far requires to be scaled up to large scale deployments and real "lab to land" transition takes place, to have societal impact.

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SANYOG

People suffering from Severe Speech and Motor Impairment (SSMI) can neither speak nor do they have control over their limbs so that they can write or use sign language to communicate with others in a normal way. This segment of the population cannot use the keyboard and the mouse, thus being alienated from normal computer usage. This factor, coupled with their speech impairment impedes their communication.

The objective of the research team at Sanyog is to develop a vernacular Augmentative and Alternate (AAC) system for people with severe speech and neuro-motor disorders to reduce the complexity of their communication in a cognitive way.

SANYOG TO THEIR AID

Sanyog is a computer-based speech-enabled Augmentative and Alternative Communication (AAC) system for the Indian population suffering from Severe Speech and Motor Impairment (SSMI).

In the original version of Sanyog, the system is verb driven. The user has to select an icon of the verb first and then the other constructs of the sentence, for example the subject, object etc. The system is integrated with a text-to-speech synthesizer for three languages – Bengali, Hindi and English – to get speech output.

This version of Sanyog has been deployed at a number of institutions such as the Indian Institute of Cerebral Palsy, Kolkata, Action for Ability Development and Inclusion, New Delhi, and Manovikas Kendra, Kolkata where it's being used by children suffering from cerebral palsy. Their response about the system is very encouraging.

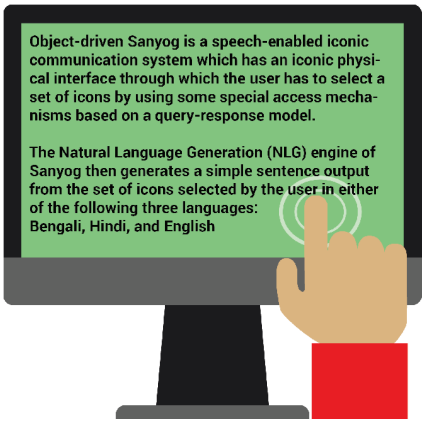
However, one of the problems with the previous version of Sanyog is that it is a verb driven system. That is, it first chooses a verb as the key sentence component and then other components are chosen and finally the sentence is generated. But children generally do not think of a sentence starting with a verb; instead, they think about an object first and then try to communicate their thoughts around it.

This observation led to the modification of the original Sanyog to make it object driven, that is, it starts with the choice of objects as sentence components and generates simple sentences around them. The dynamic iconic language set is organized hierarchically in such a way that the user has to make a

ADVANCEMENTS

For advanced users, the system provides the alphanumeric mode of communication. In this mode, the user can construct complex messages with the help of an on-screen soft alphanumeric keyboard with standard editing facilities.

Moreover, the keyboard is supported by word prediction techniques and is speech-enabled. The selection of icons or the keys in the virtual keyboard can be achieved using a special access mechanism that includes auto-scan and special selection switches to alleviate the use of mouse and keyboard.



SPARSHA

Researchers at the Indian Institute of Technology -- Kharagpur (IIT-KGP) have developed a unique technology via a software that enables conversion of Indian languages into Braille for the visually- challenged.

Sparsha is a speech-enabled bi-directional automatic Indian language text to Braille transliteration system. The system provides a unified framework for a large number of popular Indian languages.

The Sparsha Transliteration System developed by the Communication Empowerment Lab at IIT-KGP, led by Anupam Basu, can accept text in English as well as popular Indian languages as input and convert it into Braille. The software takes the text as input in Unicode and can convert it to Braille and facilitates the production of Braille textbooks.

This helps the visually challenged to access information from a variety of sources. The converted files can be printed out through any Braille embosser (printer for Braille).

Apart from English, other languages supported by Sparsha include Hindi, Bengali, Assamese, Marathi, Gujarati, Oriya, Telugu Kannada and Dzongkha.

IIT-KGP has inked deals with universities to produce necessary Braille books in regional languages through Sparsha. The institute is also planning to go for large-scale deployment in West Bengal and other states.

Among other pioneering and award-winning assistive technologies developed, there is also the 'speech-enabled Baishakhi keyboard' for the blind, enabling them to type (Bangla and English) and hear what they are typing. With this initiative the visually challenged will be able to write exams or use the Internet without any help, all by themselves.

- Automatic, forward and reverse transliteration from digital text to Braille and Braille to text.
- Supports most of the drivers for embossing the Braille code produced on Braille embossers.
- Editing facility of the generated Braille code.
- Transliteration of Mathematical Symbols and Scientific notations to Nemeth Braille.
- Speech enabled file editor with keyboard support.

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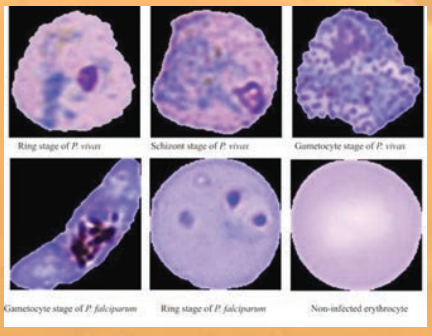
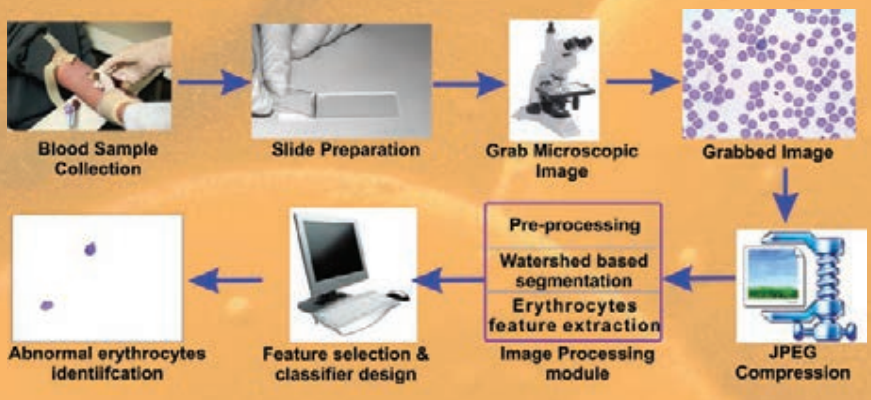
MEDICAL IMAGING INFORMATICS FOR COMPUTERIZED MALARIA

DETECTION: A web-based platform for remote diagnosis

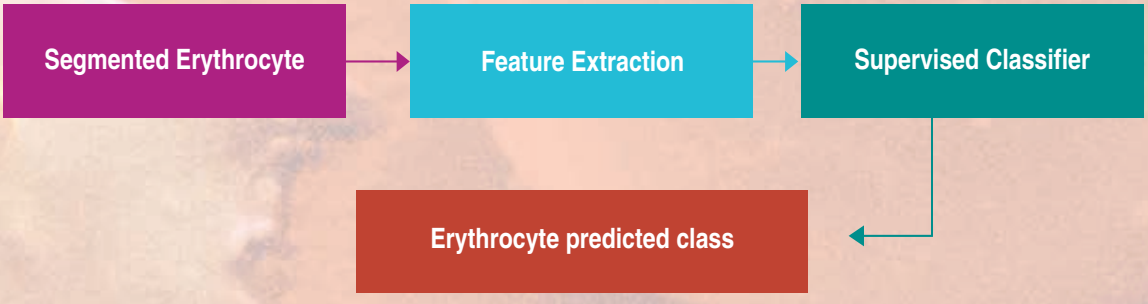
Malaria is a parasitic infected disease where Plasmodium species viz., P. falciparum, P. vivax, P. malariae and P. ovale are mainly responsible for malaria infection. It causes 1.5-2.7 millions of death per annum (Raviraja et al., 2006). In India, ~ 50-60% of malaria patients are affected by Plasmodium Vivax (P. vivax) and 40-50% of them are infected by Plasmodium falciparum (P. falciparum) which is reported in National Vector Borne Disease Control Program (NVBDCP) data for the year of 2011. P. falciparum infection is more fatal than the P. vivax infection with its worldwide prevalence rate is higher than the other type of malaria infections, and its infection rate are rapidly increasing in Indian population. There are three life stages of malaria parasite namely early ring trophozoite, schizont and gametocyte, which are visible under the microscope. In case of P. falciparum infection, typical ring and gametocyte stages are visible under microscope but in case of P. vivax infection all the three stages are visible under the microscope in peripheral blood smear slide. In practice, the conventional blood pathology test is performed to detect the infection in erythrocytes under microscopic examination. Such evaluation is practically driven by experience and knowledge of expert pathologists. In addition, the differential staging of malaria parasite based infections becomes very difficult due to overlapping color intensities. In effect, the final diagnosis involves subjectivity that leads to intra-observer variation and human error. In order to overcome such situation, pathological imaging informatics approach has been investigated here to detect malarial infection type using microscopic images of peripheral blood smear of human.

To develop computer-aided screening system for characterizing abnormal erythrocytes associated with malaria and anaemia, thin peripheral blood smear samples were collected from clinic/hospital and light microscopic images were grabbed at appropriate resolution at BMI Lab at SMST, IIT Kharagpur. Background illumination was corrected to retain background uniformity and noise level was minimized using suitable filters. Noises were introduced during slide preparation, imaging and mishandling of the slides. Erythrocytes, as region of interest were segmented automatically using watershed segmentation methodology. Basically marker based watershed method consists of region growing and edge detection method for partitioning of image into two different regions: catchment basins and the watershed lines. If an image is observed as a topographic surface, the watershed transform can be depicted as a flooding process. In such situation, a way that whenever two bodies of water from neighborhood regions meet each other, a line called dam is formed. Simultaneously two basins called catchment basins or watershed are constructed in the neighborhood seed regions.



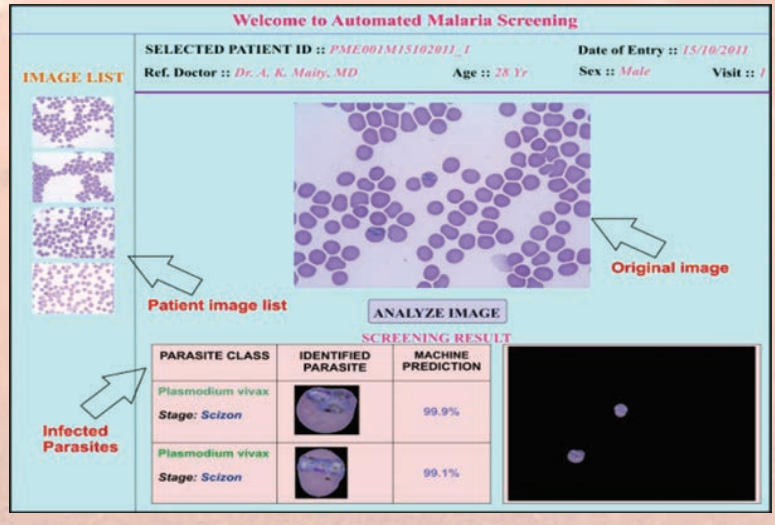


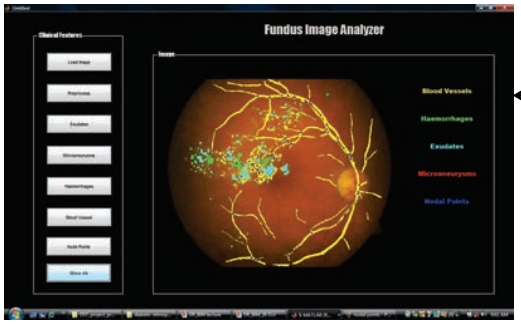
In malaria screening module, infected erythrocytes were characterized based on textural and morphological information. Total 80 textural and 16 morphological features were extracted from infected and non-infected erythrocytes. All the significant features were ranked based on their F-statistics value and information gain value separately to show highest to lowest contribution. All ranked features are divided into different sub set of features based on their ranking. Multilayer perceptron network provides significant classification accuracy for characterizing malaria infection.



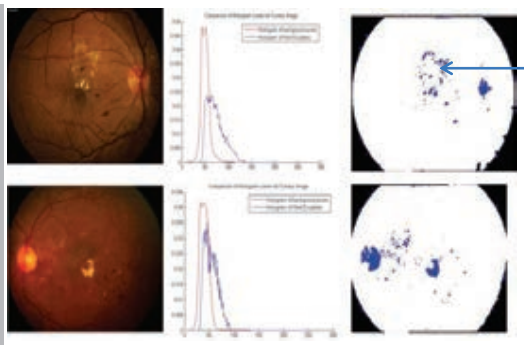
COMPUTERIZED DIAGNOSIS :-

The proposed web-based healthcare system under Java platform provides a computer assisted malaria parasite screening module which helps to detect parasite infected erythrocyte present in light microscopy images of blood smear. The computer-assisted screening application is able to identify two types of malaria vectors viz. Plasmodium vivax (Ring, Gametocyte and Scizon) and Plasmodium falciparum (Ring and Gametocyte). The developed digital blood smear image screening algorithm is implemented in the proposed real-time screening software. This figure describes the design of the proposed screening model where user can able to upload patient's blood image and screen the image with the help of screening software.





DIABETIC RETINOPATHY DETECTION USING RETINAL FUNDUS IMAGING AND ANALYTICS



Biostatistics & Medical Informatics Lab
SMST, IIT Kharagpur

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Population growth, aging, physical inactivity and increasing levels of obesity have contributed to the projected rise in the prevalence of diabetes from 2.8% in 2000 to 4.4% of the global population by 2030 [Sicree et al 2006]. However, in India, diabetes has been projected as the major disease to spread at an epidemic rate. This explosion of diabetes in urban and rural India increases the tendency for developing complications of diabetes i.e. both small vessel (micro-vascular) and large vessel (macro-vascular) disease. Micro-vascular complications are more specific to diabetes and indeed, diabetic retinopathy (DR) is considered as the hallmark of diabetes. DR is a common complication of diabetes mellitus characterized by lesions of the retinal vasculature and is one of the leading causes of blindness and vision defects in both middle and advanced age groups. With the prevalence of diabetes reaching epidemic proportions in India, DR is fast becoming significant cause of visual impairment.

In the conventional diagnosis, visual information obtained from retinal images many times create problem to the medical experts in identifying the different stages of DR viz., mild, moderate, severe and proliferative DR. All these complex changes are considered as vital clinical features in retinal image guided DR diagnosis, which requires a specialist to observe very carefully the retina at periodic examinations, and recognize small lesions and changes therein. This conventional method is practically time-consuming and subjective which eventually leads to late diagnosis. Moreover, rural areas have additional challenges such as the lack of awareness due to illiteracy and limited access to specialized health care facilities, which even if available, would be largely unaffordable due to the prevailing poverty. Regular screening for DR and more aggressive management of modifiable risk factors could reduce the numbers of people who develop sight-threatening retinopathy. It is very important to emphasize here that early detection of DR is crucial to prevent loss of vision at an early stage. Therefore there is an urgent need to make DR screening "Available, Accessible, and Affordable" to the rural as well as urban population. Routine retinal screening in diabetic individuals is thus mandatory to detect DR in its early stages and thus reduce the burden due to DR in developing countries like India. Hence taking into account the given scenario, the present proposal aims at investigating innovative techniques for design and development of a computer-assisted automated retinal image analyzer for early screening of DR.

For further information, please reach out to:
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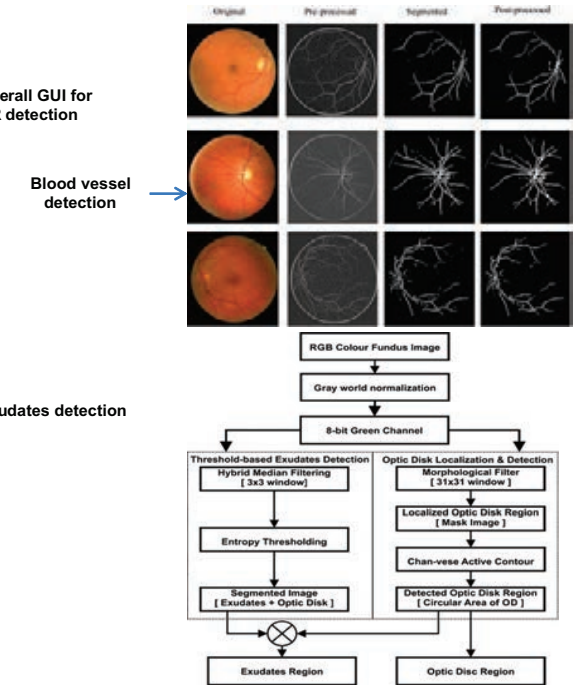
System using Color Fundus Images



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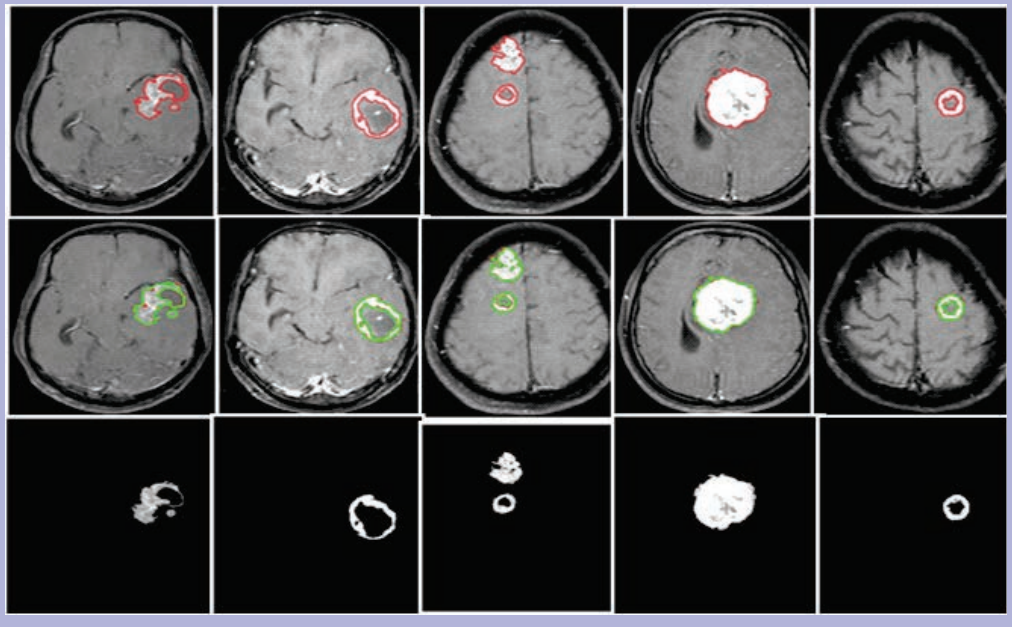
1141-1146 (2012)

Funding source: DBT, GoI

COMPUTERIZED DETECTION OF BRAIN TUMOUR FROM MRI

Brain tumour characterization is difficult, because neoplastic tissue is often heterogeneous in spatial and imaging profiles, often overlapping with normal tissue (especially the infiltrating part). Moreover, tumour is of heterogeneous in nature. The reference standard for their characterization is currently based on histopathologic analysis following surgical biopsy or resection, but this also has limitations including sampling error and variability in interpretation. Presently, clinical decisions regarding the treatment of brain tumour rely on MRI images. Conventional MR imaging is often not adequate in providing answers and calls for development of an automated tool that may assist in the imaging evaluation of brain tumour by determining the grade and differentiating between different tissue types. In view of this, the current research of our team at BMI Lab of SMST, IIT Kharagpur aims to develop a computer-assisted automated brain tumour characterization and grading tool for early detection of disease with improved diagnostic accuracy by combining MRI image intensity descriptors with shape and texture characteristics. This tool, if proven accurate, can ultimately be applied to (i) provide more reliable differentiation of brain gliomas, (ii) avoid invasive procedures such as biopsy, especially in cases 3 where the risks outweigh the benefits (iii) expedite or anticipate the diagnosis (histological examination is usually time consuming).



Results: Computer assisted brain tumour detection

TECHNOLOGICAL INTERVENTIONS FOR FOOD SECURITY

Government of India's proposal of the National Food Security Act (NFSA) aims to provide basic requirement of food to its people. The successful execution of NFSA requires revolutionary changes across crop production, procurement, storage and distribution, seamlessly coupled with information and communication technology. India needs to double its agricultural productivity by 2040 to reduce supply and demand gap. Increasing the food grain production has become a challenge because of diminishing per capita arable land and availability of irrigation water resources and expanding abiotic and biotic stresses under climate change / variability. At the same time, huge yield gap (>50%) between attainable and actual farmers yield in many parts of the country including eastern India offers the scope for meeting the challenge. Further, high agricultural output also requires better storage and logistics support as the loss due to improper storage and handling of food grain is as high as 25-35%. Increasing food grain productivity and minimizing post-harvest losses can be possible through implementation of scientific production and processing technologies in farmers' field. In this regard, Indian Institute of Technology (IIT), under Prof PBS Bhadoria as Principal Investigator, Dean SRIC, Prof Sunanado Dasgupta and Prof. P Chakrabarti , Director, has taken an initiative to demonstrate and increase awareness about existing technologies on food grain production and post-harvest processing at farmers field. With the support from Ministry of Human Resource Development, IIT Kharagpur has adopted 14 acres of land from 14 farmers in Kenthia village (Kharagpur Block–II, Paschim Medinipur), located within 10 km from the Institute campus. The land was barren for last 5-7 years without any crop cultivation even in rainy season.

The project team including Principal Investigator a and Co-principal Investigators from all disciplines of food production and processing had several meeting with the farmers and Gram Pradhan for successful implementation of the project. Lack of irrigation facility, farmers' knowledge about cropping system management, and rising labour cost are the major limitations of food production in the farming region. Hence, at the beginning of the project, a deep tube well was installed and become operational in December 2014 that encouraged the farmers to start their farming operation from dry season (December) of the year 2014-15. As rice is the major crop in the region, farmers had no interest to grow crops other than rice. But, rice cultivation during dry season cause depletion of ground water level as this is a high water demanding crop. Therefore, to have sustainable production, we introduced water saving rice production technology i.e. System of Rice Intensification (SRI) that generally saves 70-80% seed and 30-40% irrigation water requirement. Also Organic Farming technology was practiced in both SRI and conventional system for quality improvement in soil health and the food grain. To promote crop diversification, cash crop like sweet corn, peanut and soybean were introduced in addition to rice. This will increase the farmers' income as well as improve soil health and minimize the irrigation water requirement. Furthermore, vermicomposting technology was demonstrated among the farmers to encourage them to take up organic farming. Treatment of farmer's pond by applying bentonite clay was implemented as a component of Integrated Farming System to store more water throughout the year. Farmers can grow fish in pond and use the water for irrigation purpose that will improve their economy. Framers could harvest the dry season rice with yield ranging

from 5 to 5.5 t/ha after bearing the loss due to incidental rain during maturity stage of the crop. The harvested rice yield was about two times higher than the yield of farmers' practice. Also te farmers could realize higher return from other crops such as sweet corn, peanut, and sesame.

A Field Day was organized on 25 March 2015 to develop awareness among the farmers of this village and neighboring villages on scientific food grain production. Professors from IIT, Agricultural officers of West Bengal Govt., and Panhayat level official participated in the Field Day. Agricultural officers and farmers from neighboring village want to have similar project in many locations that will help capacity building of farmers on scientific production technologies and hence production improvement.

In the following wet season (June-October) of 2015, seven high yielding rice cultivars including hybrid cultivars were intrudced for comparative assessment of varietal effect. The effect of planting system such as drum seeding, transplanting and SRI were tried for the demonstration. Similarly different nutrients management technologies like chemical fertilizer, organic fertilizer, integrated management, reduced fertilizer, and SPAD-N management were demonstrated to maintain higher yield with minimum input application. Farm machinery like power tiller, transplanter, weeder, and harvester are used by the farmers for timely operations and to minimize the labour cost. A Field Day was held on 17 October 2015 to have awareness among the farmers on the performance different rice cultivars and production technologies and use of farm pond for conservation and reuse of rain water. Farmers had many queries on the production technologies and they are interested to adopt the technologies in their own field.

Future plans include implementation of solar powered lights in the common areas, sprinkler irrigation systems, taking up of different crops, conducting training sessions and adoption of more villages.

A small model has been developed around this project, which can be used to develop other villages in a similar way.

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IIT-KGP RESEARCHER
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STRENGTHENING AGRICULTURE

LAND PREPARATION

Small adjacent fields belonging to a single farmer were merged to make larger fields. Primary and secondary tillage was done by tractor driven plough followed by leveling. Converting 120 small plots into 46 larger plots.

WATER SAVING RICE PRODUCTION TECHNOLOGY:

The production technology of System of Rice Intensification (SRI), which saves 70-80-seed and 30-40% water requirement, was demonstrated in the farmer's field.

CROP DIVERSIFICATION:

Farmers had preference to grow rice crop only. However, considering the land topography, water demand and soil fertility, we introduced high value and soil restoring crops such as sweet corn, sesame, soybean and peanut. Sweet corn is an important vegetable cash crop consumed widely for its taste and nutritional benefits. It is rich in vitamins and minerals. Leguminous crops like soybean and peanut will add biological N and improve soil health for sustainable production, besides being rice source of protein and oil.

PLANTING AND HARVEST MECHANIZATION:

Drum seeder, transplanter and ripper were been introduced to farmers for mechanization of agricultural system. This mechanized equipment is use for planting of paddy seedling and harvesting of the paddy at mature stage respectively, which eliminates the use of massive manpower utilization in single process. Earlier the farmers are habited with manual paddy transplanting and harvesting process.

INTRODUCING NEW PADDY VARIETIES DURING KHARIF SEASON:

During Kharif season new paddy varieties were introduced at farmers field.

VERMICOMPOSTING:

Cow dung, water hyacinth and farm wastes are used as inputs for the composting process with 2.5-3.0 kg

earthworms (Eisenia foetida) in each bed of size 1.8m x 1.2m x 1m. Each bed is expected to produce 100 kg of vermicompost in one cycle of 60 days

POND STRUCTURE FOR INTEGRATED FARMING:

To increase economy of the poor farmers, pond size 25m x 15m. 5m x 2m is renovated to store rainwater and grow fish as component of integrated farming system. Pond was plastered with bentonite clay to check the water loss through seepage. The stored rainwater will be used to provide lifesaving irrigation.

We intend to adopt more villages, the duration of which would be one year after which the farmers would be able to sustain themselves based on leanings from the project.

OTHER ACTIVITIES

IIT-KGP RESEARCHER
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KHARAGPUR FILTER

A water Filter For the People in Water Deficit and Flood/Drought Areas

An effort is made in the present project to develop a filtration system for drought affected and flood water as drinking water solution appropriate for the rural community. The characterization of the flood water sample shows that it is unfit for consumption. The TDS, TSS, Hardness, Conductivity and Salinity were beyond the objectionable limit. A 3-stage media filter is designed to treat this water up to drinkable limit. The filter consists of three containers containing Gravel, Sand and Charcoal respectively. Various sets of experiments were performed by varying the depth of the media. It is found that the flood water parameters that were beyond the objectionable limit in all aspects (Drinking and its discharge at different places) before treatment was enhanced to drinkable limit after treatment.

The project is aimed to develop a high capacity water filter for safe drinking purpose which would be cheap, easy to operate, requires minimum maintenance, reusable, does not require power. It would be used in government or semi-government aided remote primary schools for drinking as well as mid-day meal purpose which has below quality drinking water access, domestic purposes in urban and rural households and communities, even in daily use and during natural disaster management (drought, flood, earthquake etc.)

Access to safe drinking water is an index for development. With Kharagpur Filter the drought affected and flood water can be effectively treated by a filtration process at the site itself. In this process, water passes through a filter medium and the particulate material either accumulates on the surface of the medium or is collected through its depth. The Filter has been found effective for removing particulates of all size ranges, provided that proper design parameters are used. In the recent floods, the people of Midnapur were seen waiting for up to 3 days for drinking water while standing on flood water. The filter provides a ready solution to the problem and can deliver upto 400 liters of water per day for a month with or without little maintenance.

Kharagpur Filter has been designed with the view that it will be used by poor and not-so knowledgeable people who are affected by flood and water scarcity. It does not require electrical power and processed materials.

The materials used for filtration are pebbles, fine sand and charcoal. The arrangement is that water is first put on a distribution plate (simple aluminium plate with concentric holes ,increasing in size from the center outwards).The distribution plate distributes the water all around the plate so that all portions of the filtration bed is used for filtration. From the distribution plate the water trickles in to the gravel media in the 1st container. The filtrated water from the 1 st container then trickles into the 2nd distribution plate (same as the first one) and then enters the 2nd container having fine sand (simple sieved sand).The filtrated water from the 2nd container then trickles into the 3rd distribution plate. Between the 1st container and the 2nd distribution plate there is a gap to aerate the trickling water. There is a similar gap between the 2nd container and the 3rd distribution plate for the same purpose. Repeated aeration helps increasing oxygen concentration in water (non - existent in all conventional filters).From the 3rd distribution plate the water trickles to the 3rd container which has a column of plain charcoal (used in hearths, available by controlled burning of wood).The charcoal medium reduces bad odor and removes metals by adsorption. The filtered water is as good as piped water for drinking. Kharagpur Filter is perfectly usable for domestic purposes in urban and rural households and communities, even in daily use. It is cheap, easy to use, requires easy maintenance, reusable, and does not require power and much more effective than standard water filter.

FILTER DESIGN

The filter comprises

- 3 conical container of 10 liter capacity to keep media of filtration.
- 1 collector of 22.5 liter capacity to collect the water sample after filtration.
- 3 distribution plate of 35 cm diameter to distribute the water flow.
- 2 guards of 15 cm height to restrict the water inside the plate.
- 3 brasses net of 14 cm. diameter to fixed at lower portion of the container.
- A frame to hold the arrangements and Perspex sheets to cover the two sides of the frame.

The two sides of the filter are remaining open to pass the air. This allows the aeration that may result in improvement of dissolved oxygen in water. The drawing of filter and construction of filter and each individual unit are shown in figure below.

BENEFITS AND APPLICATION:

- Simple in construction! easy to build.
- Use of locally available materials-almost free of cost.
- Easy to use and maintain.
- High capacity upto 400 liters - good for 200 liter adults per day.

DISTINCTIVENESS:

- Natural aeration-leading to increase dissolved oxygen and reduces nitrogen.
- Longer life-become of easy drying of the materials.
- Cheap- Rs 400 per unit.

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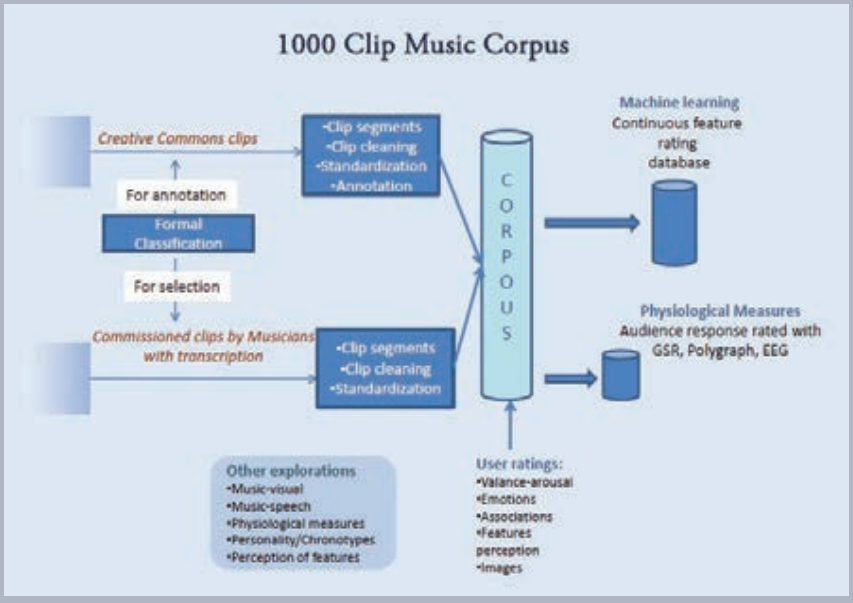
THE SANDHI OF MUSIC AND TECHNOLOGY AT IIT KHARAGPUR

Our Indian system of training in classical music is passing through hard times. Our traditional Guru-Sishya-Parampara, where the student imbibes the finer nuances of a raga through hours of face-to-face interactions with the teacher, is becoming hard to sustain in the modern context.

There are deeper questions that can perhaps be answered from a deeper understanding and perception of Indian classical music from domain experts. The primary challenge will be to learn stylistic and gharana-specific features of ragas and formally capture them under richer models of ragas. Such features may explain more esoteric aspects, such as the known classifications of ragas based on mood, seasons or time of the day.



"In our system of classical music, immersive creativity is fundamental, and this cannot be achieved without a Guru. Our goal is the Sandhi of traditional training and supplementary technology to evolve a modern pedagogy for learning music" says Professor Pallab Dasgupta of Computer Science and Engineering, who is one of the principal investigators of the project.

A team of dedicated researchers from IIT Kharagpur are exploring these goals. As a first step, a database of 1000 clips on Indian raga renditions is being created, fully annotated with music notation and finer attributes. These will be used for psycho-analytical reasoning, audience response for learning aesthetic features, and computational musicology.

"Though we belong to different disciplines, what links us together is music, which is universal," observes Professor Priyadarshi Patnaik, one of the other principal investigators of the project. Professor Patnaik and Professor Damodar Suar of the Department of Humanities and Social Sciences are looking into the human – communication-oriented, psychological and physiological responses to ragas. They hope that this will also give insights into the underlying principles that make music both communicative and appealing.

The project has brought together researchers from diverse domains -- signal processing engineers who are capable of extracting melodies and notations from recorded music, computer scientists who are studying formal language theoretic interpretations of ragas and how they are rendered, machine learning experts who are looking for hidden features that characterize the stylistic aspects of rendering a raga, communication researchers and psychologists who are exploring the relation between language, music and cognition, the emotive aspects of ragas and bandishes, and the way in which music is perceived – and of course musicians and musicologists who are providing domain expertise.

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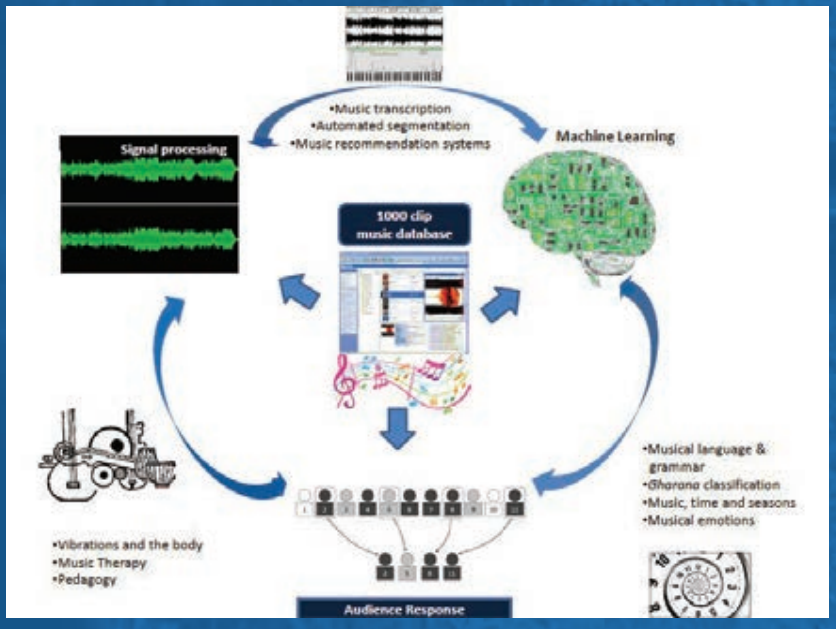

Professor Sourangshu Bhattacharya, another faculty of Computer Science wishes to unearth the underlying features that rouse emotions in us through Machine Learning. He asks, "Can we identify specific features from the music which are responsible for a given emotion? Is it due to tempo, rhythm, melodic structure or something else? We study the gamut of such questions under the frameworks of Machine Learning and Crowd sourcing." To this Professor K S Rao of the School of Information Technology adds, "It is well known that humans understand and feel music through the underlying melody, note sequences, tempo and rhythm. We are attempting to capture these characteristics automatically from the raw music signal using appropriate signal processing methods. The captured characteristics of the music can be exploited for varieties of applications such as deriving transcription, assessment of quality of music, extracting different segments of music and so on."

The music project of SanDHI, an MHRD initiative at IIT Kharagpur, is interlinked with its other arms, including language, iconography, meditation (through music), heritage structures, urban design regeneration and creative economy. In the true spirit of the ideology that drives all these projects – the integration of science and technology with tradition and culture – the music project has affinities with language, mediation (through music), therapy, psychological palliation and much more.

"These deep interlinks are what the projects, at a macro-level, wish to discover in their most mature phases," says Professor Joy Sen, the Principal Coordinator of all the SandHI projects, who explores the underlying relationship among the sound potential, speech and music. He sums up, "The idea is to augment a 'people-centric' course of India's future growth plans, strategies and development programs based on clusters of projects which involve a deeper level of philosophical research, an outward recovery of Indian heritage systems and a pro-active resurrection of our traditional knowledge systems."

Daan Utsav *The festival of Giving*

IIT-KGP students reliving the heritage of philanthropy

On October 2, a Donation Drive Box for clothes and other things was made in the student hostels and recreation centre – Technology Students Gymkhana. Also the students organized interactive sessions with the mess workers and guards at the hostels, taking photos, giving gifts and sharing joy. On October 3, health and wellness activities were organized through Yoga and Meditation camps, visits to schools and imparting training by students and coaches involved in sports. On October 4, the students visited the neighbourhood villages and distributed clothes and other items collected in the donation box. Movie screenings were organized for school students and villagers. Also the local restaurants and eateries were roped in to treat the Rickshaw pullers in the locality.

In a further initiative, the training by the societies to the students at the village schools will be continued. The students from IIT Kharagpur are also opting for the opportunity 'Teach a class' for anyone who wants to volunteer over the day or the week. The Students Welfare Group of the Institute will continue their services under programme till October 10. This will include blood donation camp, guest lecture, Ideation events, Counselling awareness videos, Student counselling.

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