SIGNATURES

Vol. 8, No. 1 & 2
August 1994

Newsletter of the Ahmedabad Chapter of the Indian Society of Remote Sensing

CONTENTS

(Edited by Dr. V K Dadhwal)

Message from Chairman ISRS-AC

Congratulations! The first "Signatures" of ISRS-AC is in your hands. This is a modest effort of our editorial team with active support from all of you. Enjoy it with your family who are in background to bring you in foreground.

Over the years, the traditional methods have given important realisation about the importance of national problems. The myths and realities of leaps and bounds growth of remote sensing activities in national development is also becoming increasingly clear. In this modern world of information explosion, conversion of 'bits' into 'knowledge' and a synergistic approach has become a necessity. To provide you a small window to the outside world has been our motto.

Greetings.

Dr. Prem Chand Pandey
Chairman ISRS-AC

Hello readers! We are back and your long wait for your favourite newsletter is over. In response to our appeal for naming our 8 year old baby, Dr. S M Bhandari floored us with a booklet of "1000 Names for ISRS-AC-NL" (well, actually there were a dozen). We picked the winner as 'SIGNATURES'. Dr. P Pangotra, who was invited to 'talk' to ISRS-AC members, also kindly accepted the invitation to communicate in a second 'spectral region'. There are two articles which highlight our optimism that best in RS is yet to come. And of course, cartoons, which are a signature of this newsletter, as Dr. S D Naik and Shri T T Medhavy survey RS and science, respectively, with a different viewing geometry. Write to us about this issue and what you would like in future issue. Previous Editorial Committees have set very high standards and we hope to measure upto their level. Happy reading, viewing, scanning, ...

Editorial Committee.

EVOLUTION AND FUTURE OF DECENTRALISED PLANNING IN INDIA*

Prem P Pangotra

Director
School of Planning (CEPT)
Ahmedabad 380 009

Shortly after independence, Indian leaders proclaimed the path of decentralised planning and administration in pursuit of developmental goals. It was a national dream that the process of development in independent India would be perfectly inclusive, in that it would involve everyone and that the national and state plans would reflect the needs and aspirations of people at the grassroots level. The record of planning process which has since evolved bears little resemblence to these goals, although we continue to pay lip service to the original dream of "planning from below".

EVOLUTION

With the setting up of the Planning Commission in the early 1950s, it became clear that the existing political and administrative structures of government favoured "top down" approaches for development planning and administration. Even the Community Development experiments, which sought to create "half a million planning commissions" through local initiative and community participation, fitted into the established channels of administration resulting in overcentralisation. The Balwant Rai Mehta Committee (1957) proposed a three tiered system of elected local bodies at village, block and district levels to actualise the ideas of decentralised planning. While this led to the establishment of the Panchayati Raj system of development administration, these institutions never really had a chance to engage in local planning. Despite the key role played by them in the success of the Green Revolution Programmes, they remained extension agencies for implementing plans of state governments and foreign aid projects.

*Lecture delivered on June 22, 1994 at Vikram Hall, SAC under auspices of ISRS-AC.

During the next three decades the "planning from above" process got fully entrenched, as did the power of vested interests, and the administration of development programmes was increasingly centralised. Consequently, development plans today are essentially handed down by the central and state governments to the local bodies for implementation. these plans do little more than allocate funds according to predetermined sectoral priorities and in no way do they represent the democratic ideals of decentralisation. Although the Planning Commission developed guidelines for district and block level planning, these were meant to streamline the administration of development rather than any meaningful decentralisation of the planning process.

Perhaps, the most significant progress towards decentralised planning in India came through the enactment in 1992 of the 73rd and the 74th amendments to the constitution to legislate the Panchayati Raj Act and the Municipal and Town Planning Acts, respectively. The latter act provides consitutional sanction for local self government in urban areas and has important provisions for granting greater autonomy to these units for instituting rational structure and functions as well as participatory decision making processes. However, the actual devolution of power, authority and responsibilities is left to the discretion of the state governments. Therein lies the problem. Political and bureaucratic culture at the state level has always resisted the sharing of power and resources with local level institutions. It is not possible to simply wish away this resistance.

ISSUES AND LEGACY

The Panchayati Raj institutions are dominated by the rural elite who are generally quite happy leaving the headaches of planning to state line departments while appropriating development funds for their personal benefit under the patronage of state level power centres. They seem comfortable with the present system in which policy decisions, financial allocations and technological inputs all come from the top. The issue is whether this nexus can be broken and replaced regular elections of local bodies and does not exclude the rural and urban poor.

The experience of district planning across various states has brought out some interesting issues. It has been observed that the relatively smaller states which undertook effective land tenure reforms, e.g. Punjab and Haryana, have grown faster and with better distribution of benefits with fairly centralised state level planning. On the other hand, larger states like UP, Bihar, MP and Rajasthan where decentralised planning has been strongly advocated, have failed miserably in terms of economic development and reduction of regional inequalities. The states like Gujarat, Maharashtra and West Bengal which are considered pioneers decentralised planning in India have also not been very successful.

PROSPECTS

For assessing the propsects of decentralised planning in India, it is important to recognize that statutory provisions are a necessary but not sufficient condition. These cannot substitute the political culture and will be required to set up a new system. Consent, commitment and active support of state governments is absolutely essential to strengthen local governments.

There is no doubt that the future of decentralised planning in India will ultimately depend on the success of political reforms for adequate representation of the poor, which will lead to more meaningful involvement of people at the grassroots. All local government institutions in the process must devise ways and means to ensure the accountability of their public officials.

At the policy level, a major shortcoming of the planning process in India has been the limitation of the overall goals. The twin goals that have defined the parameters of planning until now have been economic growth with equitable redistribution. These goals are at least partially responsible for the centralisation of the process. These goals need to be reformulated to give priority to resource management and environmental sustainable development. In addition, the success of decentralised planning would need a variety of technical inputs which may enhance local level planning capabilities. Multidisciplinary approaches to planning will be necessary and applications of remote sensing technologies can make significant contribution towards enhancing the scope of local level planning. The challenge for the remote sensing community is to foster the freedom of information and increase user access to and friendliness of applications software. The values of sustainable development are common to the field of remote sensing and local planning and these must be incorporated in our strategies for decentralised planning.

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ISRS-AC Executive Council 1994-96

The following have been elected to EC for the term 1994-96:-

Dr. P C Pandey	Chairman
Dr. S K Pathan	Secretary
Ms Beena Kumari	Treasurer
Shri I M Bahuguna	Member
Dr. S M Bhandari	Member
Shri S S Manjul	Member
Shri N S Mehta	Member
Dr. S V C Sastry	Member

Shri R C Garg, Chairman, ISRS-AC (1992-94) will continue in EC as Ex-officio.

The EC has co-opted the following members:-

Dr. J P Aggarwal	Vice-Chairman
Shri S V Raghava Rao	Joint Secretary
Shri G B Pandya	Member

SATELLITE RADAR INTERFEROMETRY

Prakash Chauhan

MWRD/RSAG/RSA
Space Applications Centre
Ahmedabad 380 053

Exposure to impressive satellite images of crinkled coastlines or mountains is now common among scientific community. Although satellite images provides magnificent visual perception of different earth features, at the same time they can be used to retrieve the useful quantitative information to understand different earth processes. As Remote Sensing is moving towards more and more quantitative approach, an exciting and promising technique called Synthetic Aperture Radar (SAR) interferometry, or INSAR makes its claim further strong. In the recent years it has been demonstrated that it is possible to produce detailed and accurate three-dimensional relief maps of the Earth's surface directly from SAR image data using INSAR technique. In addition, an extension of the basic technique, known as Differential INSAR (D-INSAR), presents the opportunity for measuring surface displacement fields (cm-scale) interferometrically by use of the coherence of the radar beam. Both of these possibilities open up many new potential application areas of space borne SAR data.

Radar Interferomerty was introduced almost twenty years ago (ref. 1), but its space borne multi-pass utilisation was actually pioneered by Jet Propulsion Laboratory scientists (ref. 2) using SEASAT and SIR-B SAR data. In SAR data each picture element (pixel) of a SAR image contain information on both the intensity and phase of the signal backscattered from the Earth's surface. However it is the phase information only (not the image intensity) that is exploited in the INSAR technique. A SAR interferometer typically consists of two SAR antennae separated by a fixed distance or baseline. Both antennae measure the backscattered signal of the Earth's surface from a single microwave source. The backscattered signals received at each antennae can then be interfered. To date no SAR interferometer have been flown in the space, but ESA's first microwave satellite ERS-1 provides an opportunity to synthesise a SAR interferometer by ingenious use of the repeat feature of the ERS-1 orbit. This is known as multi pass INSAR. If two side looking radar observations of the same scene are made from satellite locations sufficiently close together, interference between the two resulting SAR images can be obtained by comparison of the phases of the synthesized signals making up the two images. The cross orbital separation between the two orbits forms the interferometer baseline.

The complex images from each pass are superimposed (or interfered) as though they were from a single SAR interferometer. For each pixel corresponding to the same area of the ground in both images, the phase values are sub-tracted to produce the phase difference image known as an interferogram. This phase difference is a measure of the difference in path length from a given pixel to each antenna of the SAR interferometer. Using the knowledge of the orbit parameters, the phase interferogram can be related directly to the altitude on a pixel by pixel basis to generate a Digital Terrain model of the terrain. The basic difference between classical DTM extraction, using stereopairs of optical data such as SPOT stereopairs and INSAR lies in the accuracy of the final product. The phase variation between co-registered pixels gives information at the wavelength level, which ensures a better accuracy compared to coarse resolution optical data. Fig.1 shows the Interferometric SAR geometry in a pass-to-pass configuration. The spatial separation or baseline is described by B_x and B_y. The phase difference, Φ, between the two parallel or nearly parallel orbits is a function of the difference of slant ranges f_2 and f_1 and inversely proportional to the wavelength of the SAR signal.

The differential use of Radar interferometry can be assessed in terms of detection of small surface changes, such changes could be the result of shifting geological faults or the buckling of the surface due to volcanic activities, glacier flowing or slowly progressing landslides. Differential INSAR involves taking three (or more) images of the same ground area (ref. 3). Passes

1 and 2 are used to form an interferogram of the terrain topography using the basic INSAR technique. Similarly, passes 2 and 3 produce a further interferogram of the same area. The two interferogram are then themselves difference to reveal any changes that have occurred in the Earth's surface.

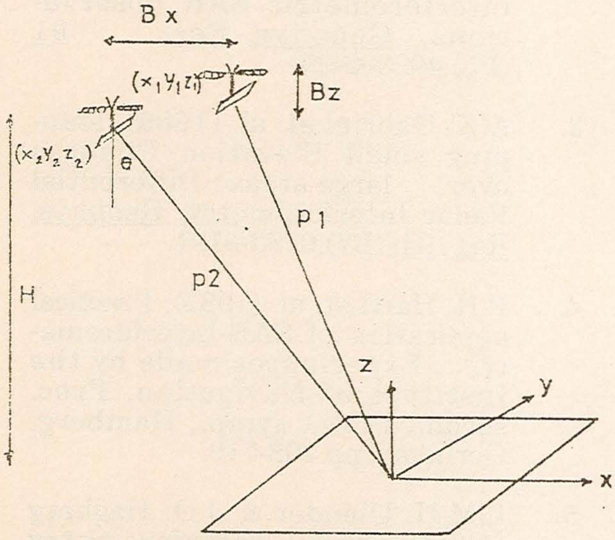

Fig. 1 : Interferometric SAR Geometry in a pass-to-pass configuration

The success of the D-INSAR method has been demonstrated for an agriculture region in the Imperial valley, California (ref. 3) using the data sets of SEASAT-L band radar. The technique was used to show regions where correlation was lost due to plowing or harvesting of fields and regions where coherence was preserved. In an another study a controlled experiment was conducted utilizing a 15 Km. array of 19 corner reflectors around Bonn, Germany. The reflectors were provided movable support and were displaced by precisely known amount. Interferometric processing were carried out by a different group which has no idea of reflector movements. The experiment produced unambiguous positive results and clearly demonstrated the capabilities of ERS-1 data to measure movements of surface features on centimetric scale. This study established that using interferometric data the height of buildings, electrical poles, depths of gravel pits can be reliably estimated (ref. 4). Interferometric data was also used to evaluate tree height and biomass for boreal forest (ref.5). Spectacular results were obtained using differential ERS-1 SAR interferometry for the estimation of millmetric scale co-seismic motion of Landers earthquake, California (ref. 6). Satellite radar interferometry has also been used for monitoring Ice sheet motion for an Antarctic Ice stream (ref. 7).

The successful demonstration of INSAR and D-INSAR methods has opened up many new potential application areas for the satellite radar data. Some of the application areas where radar interferometry can be used to get precise quantitative information are:

a) **Geosciences**

The use of differential interferometry can provide useful information on crustal dynamics after major tectonic events such as Earthquakes. The computation of co-seismic and post-seismic displacement fields for a major earthquake provides important clues in understanding the source mechanism. The technique has already been validated for long term survey of slow moving faults (typically 10 mm/year). The detection of landslides, subsidence and glacier flows are another areas where D-INSAR can emerge as a powerful tool.

b) **Terrain slope estimation**

The terrain slopes are of interest for a wide variety of applications, for example in erosion and avalanche hazard studies. For both processes terrain slope is a key parameter. Besides the direct applications mentioned above the terrain slope is required in radiometric calibration of SAR data. The local slopes can be estimated directly from the interferograms using phase gradients (ref. 8).

c) **Digital Terrain Modeling**

This is the most standard application of interferometry. DTM computation and product generation has wide variety of usefulness in different application areas and it has been demonstrated that INSAR can produce industrial quality products.

d) <u>Soil Moisture Estimation</u>

The penetration of the electromagnetic waves of the SAR into the surface becomes smaller with increasing water content in the soil. The higher the moisture content of the soil the higher the level at which radar signal is reflected. This fact can be used in quantifying the soil moisture as it will be lead to the phase variations due to changing penetration of SAR signal. The advantage of the INSAR technique would be that it is less dependent on the surface roughness than the corresponding grey level change measure, which is presently used to determine soil moisture.

e) <u>Forestry applications</u>

Interferometric phase measurements show that the scattering at C-band is close to the tree top when the forest is dense, otherwise it is related to the height and density of the trees. This fact has been utilised to estimate bole volume or biomass (ref. 5).

f) <u>Environmental Studies</u>

Change detection due to anthropogenic activities (Building of roads, mining activities, etc.) can be precisely monitored.

However like any other technique radar interferometry has its own constraints (ref. 9). The major constraint in multi-pass INSAR is that the interferometer baseline has to satisfy a condition determined by radar characteristics and the imaging geometry. The quality of interferograms can be affected by change in the nature of the terrain during successive passes (growing vegetation, man made changes, water content, etc.). Varying atmospheric depth within the different scenes can also lead to error in the phase recovery. The development of phase unwrapping algorithm for phase recovery is the most important aspect of any Interferomerty program. The studies carried out using ERS-1 SAR data have shown that it is extremely well suited for the purpose of SAR-interferometry and that this method will become of enormous importance for scientific and practical applications.

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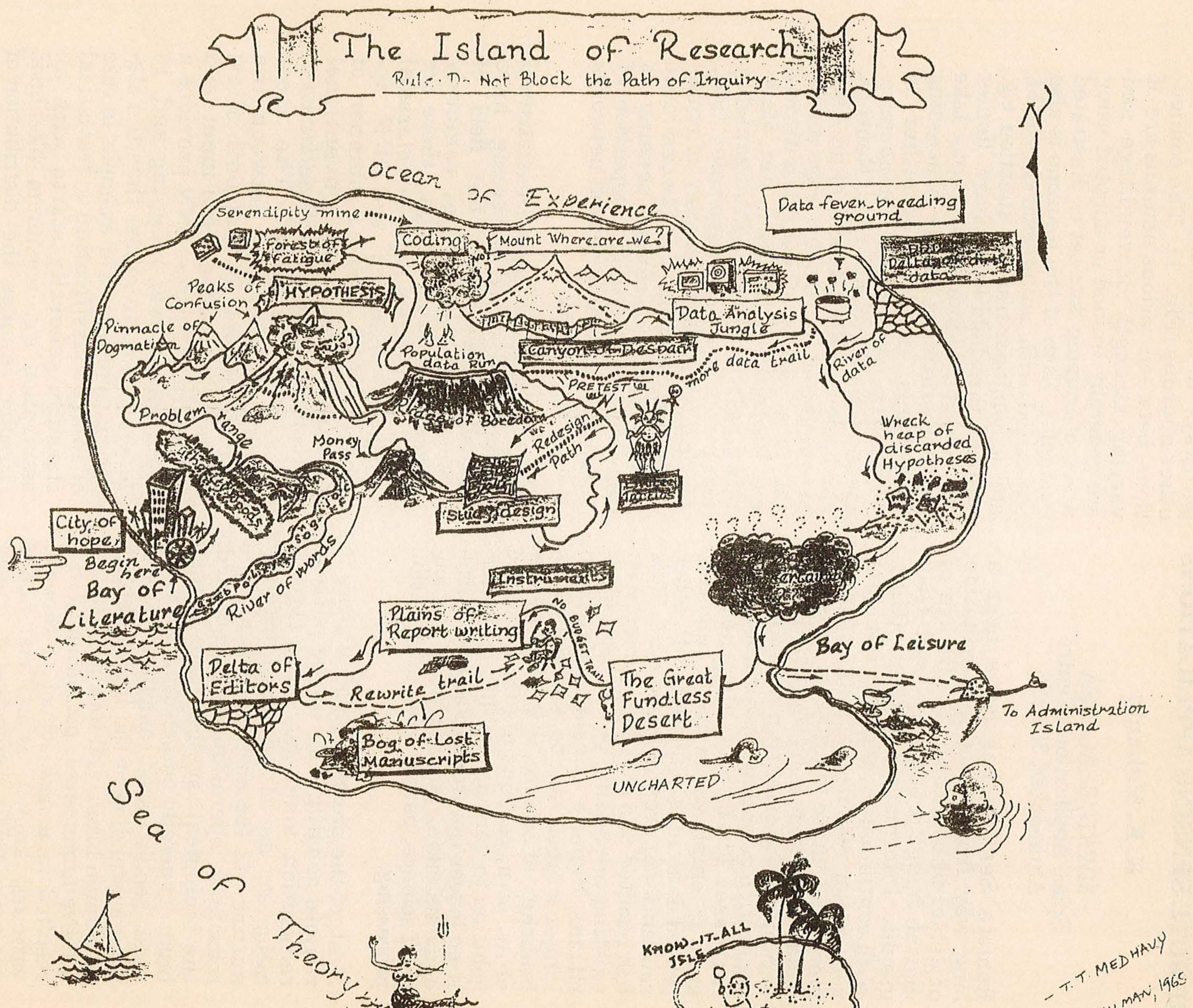
The Island of Research
Rule: Do Not Block the Path of Inquiry
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Ocean of Experience
Serendipity mine
Forest of Fatigue
Peaks of Confusion
HYPOTHESIS
Pinnacle of Dogmation
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To Administration Island
UNCHARTED
Sea of Theory
KNOW-IT-ALL ISLE
— T. T. MEDHAVY

POTENTIAL OF ARTIFICIAL NEURAL NETWORK (ANN) IN REMOTE SENSING APPLICATIONS

K. K. Mohanty

MWRD/RSAG/RSA
Space Applications Centre
Ahmedabad 380 053

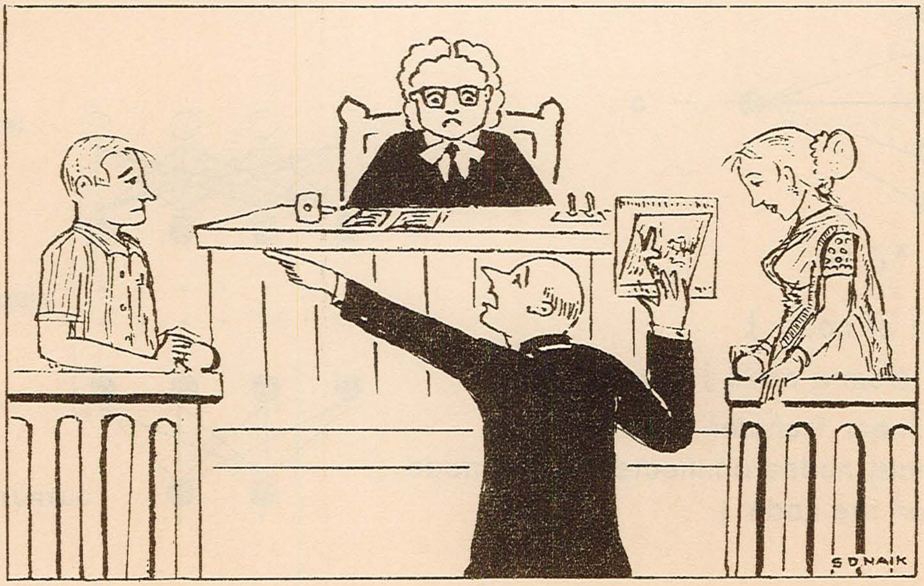
Remote Sensing has come over a long way from visual interpretation of aerial photographs to the age of digital image processing and Geographic Information System (GIS). With continuous availability of higher resolution remote sensing data in more and more number of spectral bands with increasing repetitivity, the volume of information available to application scientists is constantly on increase. There has also been a greater emphasis on use of remotely sensed data in conjunction with other conventional ground based data. This has resulted in a constant pressure on existing processing power and algorithms. Remote sensing today is no longer a mere tool to serve various branches of science, it is a technology of its own, responsible for complete solution to various real life problems. It no longer can remain aloof to developments taking place in other branches of science, particularly information processing.

Most of the processing and analysis in remote sensing *e.g.* image pattern recognition, multisource data classification *etc.*, are of logical and reasoning nature. As far as the logical and reasoning operations are concerned, the biological system like human brain generally outperforms even our most sophisticated computer system. A understanding of the broad features of human brain and its simulation to achieve human-like performance has resulted in a new school of thought, variously known as artificial neural network (ANN), connectionist model, parallel distributed processing model and neuromorphic system. Analogous to a neuron in human brain, ANN consists of many simple nonlinear (often analog) computational elements, called neurons or nodes, linked together through a dense interconnection among the individual neurons (*For a review, see Brunak and Lautrup, 1988*). Each of the neurons receives inputs from a large number of other neurons and generates a single output which passes through many pathways to provide inputs to many other neurons (Fig. 1). The connections between various neurons are of varying strength or weightage and are generally trained or adopted using a set of training data set or illustrated examples. Each of the neurons is also associated with an internal threshold, and a nonlinear transfer function *e.g.* sigmoid, threshold logic, hard limiter *etc.*, to map its input to its output. Like the conventional image processing techniques, an ANN is either of parametric (supervised) or nonparametric (unsupervised) type. Neurons, the basic building blocks of an ANN are organised in various ways resulting in a variety of neural networks *e.g.* Perceptron, Hopfield net, Hamming net, Kohonen self-organising feature maps *etc.* (*see Lippmann, 1987, for details*). A block diagram of multilayer perceptron, a network most widely used in remote sensing is shown in Fig. 2. A brief comparison of some the important neural networks is listed in Table-1.

For the last two decades, the statistical analysis and signal processing have virtually reigned over the field of processing/analysis of remotely sensed data. Even though, there are some similarities between classical statistical approach and ANN approach, ANN offers a number of advantages over the conventional statistical approach (*see Bendiktsson et al., 1990*) (Table-2). The most important similarity between the two approaches is that both allow mapping between a set of input and output vector pairs. ANN provides a highly nonlinear mapping and, in general, is more robust than the statistical approach. For example, in case of image classification a statistical classifier generally starts with an assumption *e.g.* maximum likelihood classifier assumes the distribution of input patterns to be strictly Gaussian, and generates a decision region based on the statistical parameters of the input patterns. A multi-layer perceptron, on the other hand, doesn't need any assumption regarding the distribution of input pattern classes and can model any complicated decision boundary separating the pattern classes (*see Mohanty, 1993*). It can also take into account both spec-

TABLE 1 : BASIC FEATURES OF SOME OF THE WELL KNOWN ARTIFICIAL NEURAL NETWORKS

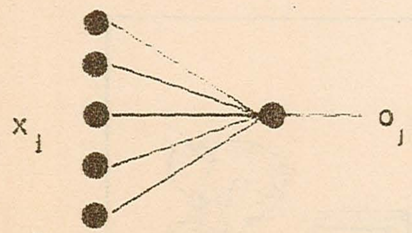
Basic feature of the network	Hopfield network	Perceptron	Kohonen's self organising map
Inventor/ developer	John Hopfield, California Inst. of Tech.	Frank Rosenblatt, California U.	Teuvo Kohonen, Helsinki U. of Tech.
Year	1982	1957	1980
General topology or network configuration	A series of neurons with output of each neuron being fed to all neurons in the net	Feedforward type network with layers of neurons without any inter-layer connection	Inputs connected to a layer of output neurons which are highly interconnected
Major applications or usage	Used as associative memory. Solves optimisation problems and retrieves image or complete data from noisy data	Most widely used in remote sensing Performs mapping for both continuous valued and binary inputs	Maps one geometrical region to another. Used mainly for image clustering in remote sensing
Limitations	Can use only binary inputs	Sensitive to scale of input patterns	Needs large scale training



Moreover, instead of taking my client for outing he showed the places on satellite imagery

TABLE 2 : ADVANTAGES OF ANN APPROACH OVER CLASSICAL STATISTICAL APPROACH

ANN APPROACH	STATISTICAL APPROACH
1. Parallel computation; supports analog VLSI implementation	1. Serial computation; does not support VLSI implementation
2. Adaptive in nature i.e. network can be trained for additional training data	2. Generally processes all training data simultaneously and, hence, not adaptive in nature
3. Distribution-free i.e. doesn't need any assumption regarding distribution of input patterns	3. Starts with some assumption regarding distribution of input patterns e.g. Gaussian
4. Mapping function is highly nonlinear	4. Mapping functions are simple mathematical functions of fixed degree and order



$$o_j = f\left(\sum_{i}^{n} w_{ji}\, x_i - \theta_j\right)$$

o_j = output of node j

w_{ji} = weight from a node j to a node i

f = a non-linear transfer function

n = no. of input nodes connected to the node

x_i = output of the node i

Fig. 1 : A typical neuron in ANN

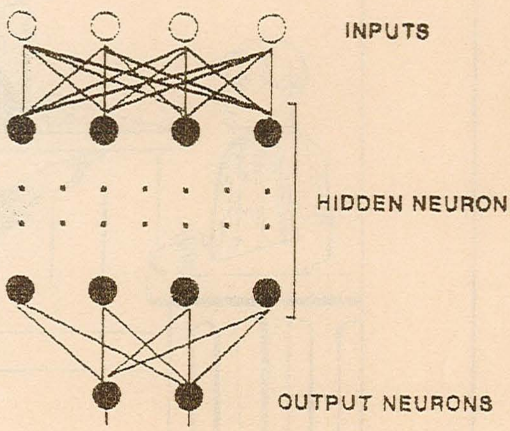


Fig 2 A multi-layer perception

tral and spatial information available in remotely sensed data. Applications of ANN have been demonstrated widely in the fields of image classification, clustering, texture analysis, noise removal and pattern recognition.

In case of a wide range of applications in remote sensing *e.g.* crop yield modeling, soil moisture estimation, meteorological and oceanographic forecasting *etc.*, it is possible to measure/quantify a large set of data comprising of effects/outputs *e.g.* crop yield, soil moisture *etc.* and causes/inputs *e.g.* rain fall, sun shine hour, soil temperature *etc.*, and the problem lies in establishing a relation between the inputs and the outputs. Being nonalgorithmic in nature, ANN allows mapping between a set of inputs and outputs without knowing the physical processes governing the phenomenon *e.g.* it is possible to relate soil temperature with soil moisture without knowing the thermal diffusivity/conductivity relation and bulk density, provided a large set of observations of soil temperature and moisture is available (*see Altendorf et al.*, 1992). A statistical analysis (regression) also serves the same purpose. However, the real strength of ANN lies in nonlinear mapping, since most of the physical processes are believed to be nonlinear in nature.

In remote sensing, the main trend in research involving ANN has been to establish its usage and to assess its advantages using the present day von Neumann type serial computers. However, all such studies fail to make use of its massive parallelism and support for analog VLSI implementation. A VLSI implementation of ANN yields tremendous processing power which can even lead to real time processing of remote sensing data. For instance, study has already indicated potential of ANN for real time processing of polarized SAR data to identify broad scale features like urban, park and water bodies (*see Azimi-Sadjadi et al., 1993*). At present, ANN research in remote sensing is only at its infancy. However, it is already established as a promising general purpose tool for a wide range of problems in remote sensing. Keeping in mind the large volume of remote sensing data to be handled in future, it seems to be the only solution.

Suggested readings

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CHAPTER ACTIVITIES

ISRS-AC continues as one of the most active chapters of ISRS. These activities are a success because of the support and selfless service by all members and Executive Council. We record these activities in order to say 'thank you' and hope you will continue to make future activities a success too.

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A popular lecture "Remote Sensing and its Applications" was delivered by Shri D.S. Kamat at School of Planning, Gujarat University on September 10, 1993.

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A science quiz for higher secondary school students was organised at SAC on October 7, 1993. Prof. N.V. Vasani, Pro-Vice Chancellor of Gujarat University was Chief Guest. The first and second prizes were won by BEST Higher Secondary School, Maninagar and Vidyanagar Higher Secondary School, Wadaj, respectively.

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National Symposium on "Microwave Remote Sensing & Users' Meet" was organised at SAC on January 10 & 11, 1994 to commemorate completion of 10 years of ISRS-AC in December 1993. The proceedings was also brought out.

*

Election for the Executive Council (1994-1996) was held on March 8, 1994, at SAC with Dr. P.C. Joshi officiating as returning officer. The new executive council is reported elsewhere. You haven't seen it!!! Please improve your "sensing" and instead of "passive" become "active" member of ISRS-AC.

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The Ninth Annual General Body Meeting, 1993-94 was held at SAC on May 5 and 77 members attended the meeting. What transpired at meeting can be viewed by Scanning minutes of meeting. However, it ended on a high note with Sumptous high tea.

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A lecture on 'Evolution and Future of Decentralised Planning in India' was delivered by Dr. Prem P Pangotra, Director, School of Planning (CEPT), Ahmedabad on June 22, 1994 at SAC. We report this lecture in Speaker's own words on page 2.

<u>Activities Planned for coming months</u>:-

a) Professor Narendra Bhandari, PRL, will deliver a lecture on "Collisions and Catastrophs" on October 3, 1994, at 1600 hours at Vikram Hall, SAC.

b) Dr. Baldev Sahai, Dy Director (RS) and Mission Director RSAM will deliver a lecture on "Remote Sensing in implementation of Agenda 21" on October 14, 1994 at 1600 hours at Vikram Hall, SAC.

b) An educational tour to Balaram watershed (160 kms from Ahmedabad) and marble quarrying site at Ambaji is tentatively planned for November 26, 1994. The members may await for more details from Secretary ISRS-AC.

c) A painting competition for children of ISRS-AC members is planned for November 1994. This event is likely to be sponsored by a reputed drawing materials manufacturing company. Complete information would be available soon.

NEWS - INTERNATIONAL

SMALLSAT

NASA awarded two contracts on June 8, 1994 to two private USA companies to build two small high-tech Earth-observing satellites within two years for less than $110 million, under SMALLSAT program. The satellite 'Lewis' will be built by TRW Space & Electronics Group of Redendo Beach, California for $59 million and will feature 384 spectral bands. The second satellite 'Clark' will be built by CTA Inc. of McLean, Virginia for $49 million and will provide 3-meter resolution images. This will compete with 1 m satellite image being planned by Eyeglass Corporation.

LANDSAT-6

Landsat-6 satellite carrying Enhanced Thematic Mapper (ETM) was launched on October 5, 1993 from Vandernberg Air Force Base, California. The satellite was declared "lost". Earth Observation Satellite Company (EOSAT) which markets MSS and TM data has started receiving and marketing IRS LISS-I and LISS-II data.

1-m SPATIAL RESOLUTION SPACEBORNE DATA

After several months of debate within US administration, the US government announced on March 10, 1994 that it would permit US companies to launch privately owned, commercial remote sensing satellites and to export the images having ground resolution of upto 1 m. Uptil now this has been the domain of spy satellites. SPOT-5, expected launch date 1999-2000 is expected to provide only 5 m pan and 10 m multispectral data. Two US companies have already obtained licence from US government. Eyeglass a company floated by Orbital Sciences Corporation (Dulles), Itek Optical Systems (Lexington) and GDE Systems of San Diego, plans to launch its satellite in early 1997 and has tied with Eirad Co. Ltd. of Riyadh for providing majority of the funding for its $150 million, 1m resolution satellite. Space Imaging Inc. is also planning to sell 1 m spatial resolution data and is backed by Lockheed Corporation and E-Systems Incorporated. It has already secured finances of $220 million to build and operate its satellite. Both companies believe that 1 m spatial resolution imagery would compete with aerial photography. Technical details and optical designs would be frozen in 1995 and planned launches are in 1997.

NEWS - INDIA

The name of Dr. Vikram Sarabhai, the father of Indian Space Programme, was inducted into the International Space Hall of Fame at the Space Centre, Alamogordo, New Mexico, USA, on Saturday, October 2, 1993.

*

Dr. Krishnaswamy Kasturirangan took over the Chairmanship of Indian Space Research Organisation (ISRO) from Prof. U R Rao on March 31, 1994.

*

The first developmental flight of indigenously developed Polar Satellite Launch Vehicle (PSLV-D1) took place on September 20, 1993 from the Sriharikota Launch Complex. PSLV-D1 carried 846 kg IRS-1E satellite which had Monocular Electro-Optical Stereo scanner (MEOSS) payload supplied by the German Space Agency, DLR and Linear Imaging Self Scanner (LISS). The first two stages performed as per specification, however, deviations developed from flight path in third stage. A Failure Analysis Committee looked into flight data and attributed the failure to a software error in the pitch control loop of the on-board guidance and control processor.

*

An agreement was signed by Prof. U. R. Rao and Dr. Arturo Silvestrini, President EOSAT at IAF Congress in Graz, Austria on October 21, 1993 under which EOSAT will receive and market IRS data. The ground station at Norman, Oklahoma has been now modified and started receiving IRS-1B data.

*

After successful launch on July 23, 1993 by Ariane Vehicle of Arianespace, INSAT-2B was declared operational on August 10, 1993.

Article Update

We bring to readers' notice some Indian work on remote sensing which is published outside the core remote sensing journals (Photonirvachak, Int. J. Remote Sensing, Remote Sensing Environment, Photogram. Engineering & Remote Sensing, ITC Journal, IEEE Trans. Geoscience & Remote Sensing) but is of interest to our readers. Readers may also submit such a selection to the Editorial Committee members.

1. Joseph, G., Iyengar, V.S., Nagachenchaiah, K., Kiran Kumar, A.S., Aradhye, B.V., Kaduskar, V.N., Dave R.K. and Nagrani C.M. (1994), Very High Resolution Radiometers for INSAT-2. Current Science, 66 (1):42-56.

   This paper describes design, development and qualification of VHRR from INSAT-2. Their ground truth results and inorbit performance parameters are compared with the design specifications.

2. Hegde, V.R., Shreedhara, V., Hegde, V.S. (1994), Changing land use/land cover pattern in the Kali river basin in Western Ghats, South India, Current Science, 66 (2):128-137.

   Multidate satellite data have been used to quantify the landuse/landcover changes in the Kali river basin for the period 1975-88. An attempt has also been made to predict the changes in landuse/land cover that would be induced in the area to be submerged due to the proposed dume of the Bedtiana the Aghanaghini Hydel projects.

3. Rao, U.R., Rao, D.P., Rao, R.S., Chandrasekhar, M.G., Radhakrishnan, K. (1993), Latur earthquake - Selection of site for rehabilitation of the affected villages in Latur and Osmanabad districts of Maharashtra, India : A Remote Sensing based Study. Current Science, 65(10):772-774.

   Using IRS-1B derived lineament map at 1:50,000 scale, ground truth on affected village and using variative criteria for site selection.

Forthcoming Symposia

1. Symposium on Remote Sensing for Environmental Monitoring and Management with Special Emphasis on Hill Regions and Annual Convention of Indian Society of Remote Sensing, Oct 19-21, 1994, Dehradun.
   - Prof. S.K. Bhan, IIRS, 4 Kalidas Road, P B No. 135, Dehradun 248 001.

2. International Conference on Remote Sensing and GIS, Dec 3-6, 1994, Hyderabad.
   -Prof. I.V. Muralikrishna, ICORG-94, Secretariat, Jawaharlal Nehru Technological University, Mahavir Marg, Hyderabad 500 028.

3. Eighth National Space Science Symposium, SPL, December 19-24, Thiruvananthapuram.
   - Dr. B.V. Krishnamurthy, Director, SPL, VSSC, Thiruvananthapuram 695 022.

4. Fifteenth Asian Conference on Remote Sensing, Nov. 17-23, 1994, Bangalore
   - Shri K Radhakrishnan, ISRO-HQ, New BEL Road, Bangalore 560 094.

5. National Seminar on Conservation and Sustainable Development of Coastal Resources. Dec. 14-17, 1994, Behrampur, Orissa.
   - Dr. R.C. Panigrahy, P.G. Dept of Marine Sciences, Behrampur University, Behrampur 760 007.

ABOUT MEMBERS

ISRS-AC members have continued with their hardwork in various scientific spheres and have earned lot of appreciation of their peers. Some of this also results in awards, election to Scienfific/Professional bodies and climb on hierarchy ladder which we list below. Any omission, is inadvertent. Please communicate such achievements about yourself or your colleagues to Secretary or members of Editorial board.

*

Dr. R. N. Jadhav of SAC shared with Shri S.K. Shivkumar of ISAC the 'Indian National Remote Sensing Award' for the year 1993 given by ISRS. The prize was presented at Annual Convention of Society at Guwahati on November 25, 1993. He wins this award for outstanding contribution to the study of forests using RS data.

*

Shri P S Thakker of SAC received 'Hari Om Ashram Prerit Shri Puranji Paritoshik for year 1992-93 in the field of 'Environment and Social Services' for his services in the field of environment awareness and education and adult education.

*

Shri A Narayana, received ISRS Award-1993 for the best paper published in the Journal of Indian Society of Remote Sensing during the year 1992 for the paper 'Normalisation of Multidate Digital Remote Sensing Data Using Scene Statistics' (Vol. 20, No. 2&3).

*

The award for the best poster presentation at National Symposium on Remote Sensing for Hill Development (Guwahati, November 1993) was shared by Dr. S.K. Pathan, SAC, for his poster "Routing Analysis using GIS Network" with Shri D. Misra of ORSAC.

*

Dr. S.K. Pathan, SAC, was awarded best paper presentation by Computer Society of India for the paper "Potential of Geographic Information System Network for Perspective Planning" during the seminar on "Computers in Public Systems" at Ahmedabad in December 1993.

*

Shri Pramod Kale (President ISRS 1992-1994) took over charge of Director VSSC, Thiruvananthapuram in February 1994.

*

Dr. George Joseph (President ISRS 1994-1996) took over charge of Director, SAC, Ahmedabad, in February 1994. He has been elected unopposed for the post of President ISRS for the term 1994-1996.

*

Dr. Baldev Sahai (President ISRS, 1988-1990 and Chief Editor Photonirvachak) took over charge of Deputy Director (Remote Sensing), SAC in February 1994.

*

Dr. R R Navalgund took over the charge of Group Director, Remote Sensing Applications Group (RSAG), RSA, SAC in February 1994.

*

Dr. Pranav S Desai was appointed as Group Head, Meteorology and Oceanography group (MOG), RSA, SAC in February 1994.

*

Dr. Ajai was appointed as Head of Environmental & Integrated Studies Division of RSAG, SAC in March 1994.

*

Shri J S Parihar was appointed as Head of Agricultural Resources Division of RSAG SAC in March 1994.

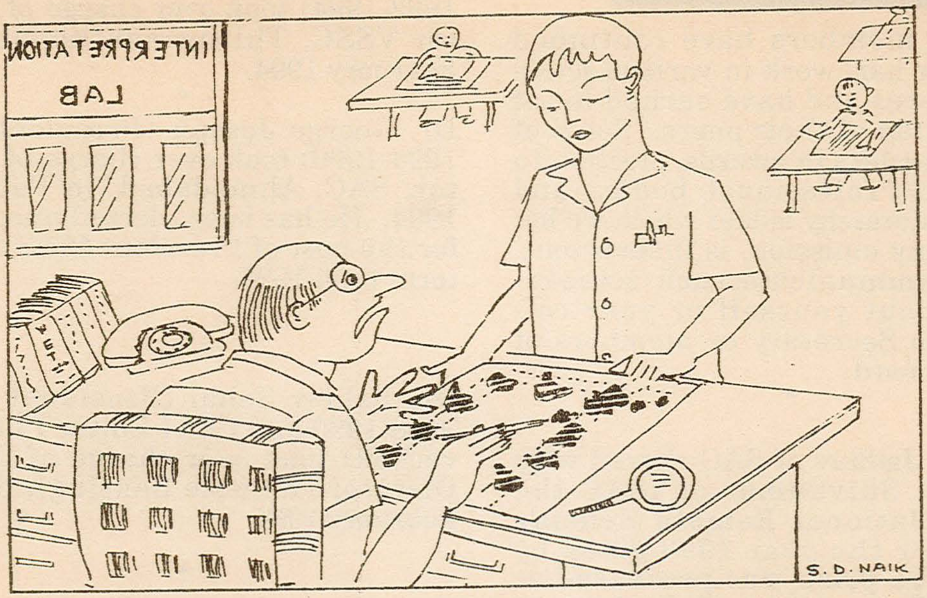
*

Dr. Praful D. Bhavsar and Dr. Baldev Sahai, past presidents of ISRS are among the first four fellows of Indian Society of Remote Sensing. Other two fellows are Dr. L.R.A.Narayan and Prof. B.L.Deekshatulu. They would act as Core Committee to scrutinize the nominations and recommend the names for election as Fellows.

*

Dr. S.R. Nayak was elected to the post of Joint Secretary of the ISRS Executive Council for the term 1994-1996.

- CONGRATULATIONS TO ALL OF THEM



Nonsense ! What do you mean by fracture controlled wetlands ? They are all city roads damaged due to rains

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Secretary, ISRS-Ahmedabad Chapter
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Ahmedabad 380 053

Edited by:

V K Dadhwal, S K Kothari, R M Gairola, N Ravi, Anjali Bahuguna,
K Padmanabhan, Space Applications Centre, Ahmedabad 380 053
A A Ahluwalia, Botany Department, Gujarat University, Ahmedabad

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