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President's Message

Glen N. Williams

Howdy! Welcome to another issue of the IEEE Oceanic Engineering Society Newsletter. I'm going to take the President's prerogative in this particular issue and talk to you for a few minutes about three particular topics which are very important to the Oceanic Engineering Society. The first topic is that of Society membership. In the Fall of 1990 the Oceanic Engineering Society mailed to all of its members the letter from Dr. Ferial El-Hawary at the Technical University of Nova Scotia and me in our capacities as the membership gurus for the OES. This letter was accompanied by three membership brochures for new members to join both the IEEE and the Oceanic Engineering Society. We asked you at that time to give these brochures to colleagues that you felt were interested in the OES and its activities, as well as those who are qualified to be members of other societies within the IEEE. I haven't seen the statistics yet on that particular membership solicitation; however, I hope that we had significant participation by our members. It's very important to me as a fellow member of the Society for the past 15 years that we get the right body of colleagues into the OES. I think that it is a significant opportunity for professional development. It's also an opportunity to work with colleagues in the same disciplines and technologies as ourselves, and I have also found it over the past years to be an absolute gold mine of friendships developed throughout the nation and throughout the world. I hope that as members of the OES, you have taken it upon yourselves to offer your colleagues the advantages of membership in the OES. If you have misplaced or lost your membership brochures and need more for either student membership for those of you who are at universities, or membership for colleagues in both government and industry, please feel free to call Dr. El-Hawary or me, and we will make sure you get the number of membership brochures that you feel you need. Thank you very much for your participation in this effort — I think it speaks well for the future of the Oceanic Engineering Society.

As members of the OES and members of the oceans community, I'm sure that all of you are well aware that Oceans '91 will be held at the Hilton Hawaiian Village in Honolulu, Hawaii on October 1-3, 1991. Ladies and gentlemen, this will be an incredible experience, I guarantee it. The most important aspect at this conference is the technical program. Under the superb guidance of Dr. Joe Vadus of NOAA and NSF fame and Dr. Paul Yuen of the University of Hawaii, the technical program has been selected from three hundred plus abstracts submitted by people who are

(Continued on page 3)

(Continued on inside back cover)

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President's Message

(*continued from page 1*)

interested in the oceans and who are actively engaged in state of the art research and development. I have been working with Joe throughout his ongoing efforts in the production of this particular technical program and, knowing the organizational structure of the program and the topic areas in which he actively solicited input, this promises to be one of the more technically oriented programs in the history of the Oceans Conference. The topic areas represent all of the technical committees within the IEEE/Oceanic Engineering Society and will include sessions in acoustics, underwater vehicles, and ocean resources, just to mention a few. I want to take this opportunity to express my sincere appreciation to Dr. Vadus and Dr. Yuen. Without the efforts on the parts of these two gentlemen, as well as their very competent staffs, the technical activities of this conference would not be of the caliber which you will be soon seeing through the publication of the Preliminary Technical Program. As a secondary note to the technical program, I have visited the Hilton Hawaiian Village and, not only is it a superb surrounding for a conference such Oceans '91, it is also an incredible environment for spending three days in Hawaii. The facilities at the hotel are quite impressive and will create a very satisfactory atmosphere for technical interchange. The hotel is also located in Waikiki and is convenient for shopping, tours or other activities for Oceans '91 attendees. Also, appreciation of the Oceanic Engineering Society must also be extended to the General Chair of Oceans '91, Mr. Kiman Wong of Hawaiian Telephone. Kiman has been ably assisted by his staff of volunteers. The conference coordinator, Miss Lianne Loo Chan, must also be recognized by the OES, for her efforts on behalf of the conference.

The third topic that I would like to address in this newsletter is the upcoming workshop on Neural Networks for Ocean Engineering This workshop is scheduled for August 1991 and is being co-chaired by Dr. Rui de Figueiredo and Dr. Ferial El-Hawary. The General Chair of this conference is Dr. Barbara Yoon of DARPA, and this promises to be one of the highlights of the 1991 Oceanic Engineering Society year. The cast of organizers and speakers reads like a Who Who's list in the underwater world, specifically that of Neural Net applications, and it would probably be to the advantage of each OES member who has a Neural Net interest to sign up for this particular workshop as soon as possible. Fliers are in production now and on the way out to the OES membership, in addition to other societies.

I apologize for being so long winded in this particular newsletter but I felt that these three topics are important to the OES membership. Thank you for your kind attention and I will see you in the next edition.

Glen N. Williams
President, Oceanic Engineering Society

DISTINGUISHED TECHNICAL ACHIEVEMENT AWARD

Oceanic Engineering Society Oceans 1990

ROBERT C. SPINDEL

This award is given in recognition of Robert Spindel's record of excellence and technical innovations in the field of ocean engineering and acoustic positioning. A prolific writer, Dr. Spindel authored or co-author more than 80 publications and symposia presentations and holds several patents in underwater acoustic positioning. He has served on many national advisory panels and committees, including those of the Naval Research Advisory Committee, and is a member of the National Research Council's Naval Studies board.

Dr. Spindel received his B.E. in Electrical Engineering from The Cooper Union in 1965, and an M.S., M.Phil. and Ph.D. in Electrical Engineering from Yale University in 1966, 1968 and 1971, respectively. Following postdoctoral research at the Woods Hole Oceanographic Institution, he joined the Scientific Staff of the Institution in the Department of Ocean Engineering. While Chairman of the Department, Dr. Spindel was responsible for operation of the research submersible ALVIN and the development of the instrumentation to find the Titanic. Since 1987, Dr. Spindel has been the Director of the Applied Physics Laboratory at the University of Washington.

Dr. Spindel was awarded the A.B. Wood Medal by the British Institute of Acoustics and the Gano Dunn Medal from The Cooper Union for the advancement of Science and Art for achievement in engineering. He is a Fellow of the Acoustical Society of America and a past member of its Executive Council. He is also a past editor of the American Meteorological Society's Journal of Oceanic and Atmospheric Technology. A Senior Member of IEEE, Dr. Spindel serves as Associate Editor of the IEEE Journal of Oceanic Engineering and was Chairman of the IEEE/Marine Technology Society Conference, OCEANS 89.

OCEANIC ENGINEERING SOCIETY

Distinguished Technical Achievement Award

1975	Robert Frosch	1980	Neil Brown	1985	William N. Nierenberg
1976	Werner Kroebel	1981	No Award	1986	Robert J. Urick
1977	Howard A. Wilcox	1982	Ira Dyer	1987	James R. McFarlane
1978	Richard K. Moore	1983	Alan Berman	1988	Chester M. McKinney
1979	David W. Hyde	1984	John B. Hersey	1989	Victor C. Anderson

DISTINGUISHED SERVICE AWARD

Oceanic Engineering Sociery Oceans 1990

ANTHONY I. ELLER

This award is given in recognition of outstanding, creative leadership and initiative in inspiring and guiding the founding of the Council on Oceanic Engineering and the transition to the Oceanic Engineering Society, and for vigorous and long standing commitment to the technical strength of the Oceanic Engineering Society. Tony Eller has fulfilled the offices of President, Vice President, Awards Chairman, as well as many other official and ad hoc functions. His dedication and service to the Oceanic Engineering Society and IEEE has been second to none.

Dr. Eller received his A.B. in Engineering and Applied Physics in 1960 from Harvard and his M.S. and Ph.D. in Electrical Engineering from the University of Rochester in 1963 and 1966, respectively. He has had a broad variety of professional experiences that include independent university research, teaching physics and underwater acoustics at the U.S. Naval Postgraduate School, coordination and management of ASW-related exploratory development programs at Navy laboratories and at the Office of Naval Technology, and employment as a contractor in support of Navy R&D programs. His professional efforts have been primarily in the field of underwater acoustics and recently have been concentrated in the specific area of oceanic influences on ASW sonar design and performance modeling. He currently specializes in the environmental acoustic analysis and modeling of system performance.

Dr. Eller is currently a senior acoustician at SAIC where he develops and evaluates models of the performance of active acoustic systems in both monostatic and bistatic configuration. Prior to that, he was a member of the Requirements and Assessment Office of NORDA, and he also worked as a Program Manager at the Office of Naval Technology.

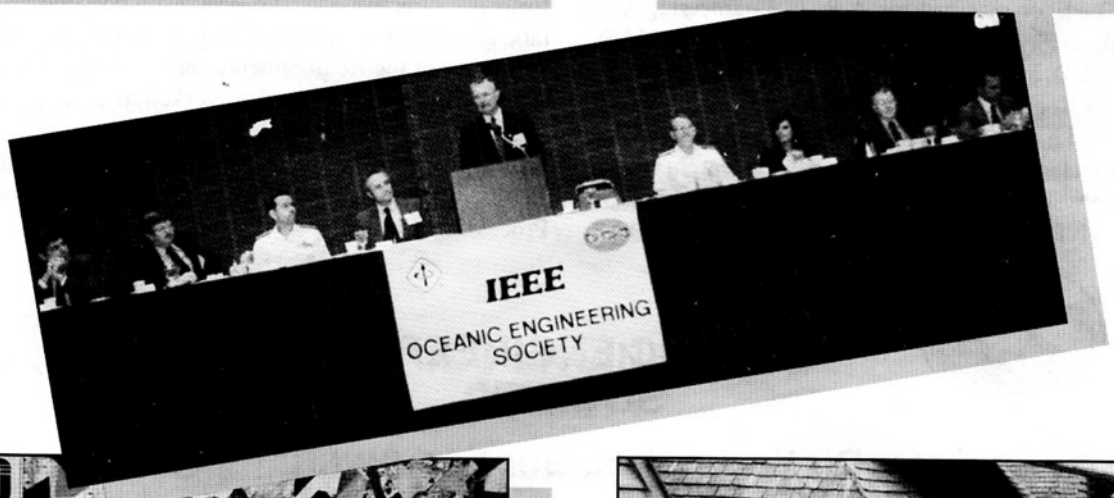
Dr. Eller received the IEEE Centennial Medal in 1984 from the IEEE Acoustics, Speech, and Signal Processing Society.

OCEANIC ENGINEERING SOCIETY

Distinguished Service Award

1975	Arthur S. Westneat	1980	Donald M. Bolle	1985	Joseph R.Vadus
1976	Frank Snodgrass	1981	Lloyd Z. Maudlin	1986	Stanley G. Chamberlain
1977	Calvin T. Swift	1982	Arthur S. Westneat	1987	Stanley L. Ehrlich,
1978	Edward W. Early	1983	Elmer P. Wheaton	1988	Harold A. Sabbagh
1979	Richard M. Emberson	1984	John C. Redmond	1989	Eric Herz

Oceans Conference
Washington, DC, 1990



(Reprinted from Oceans '90 Proceedings)

Seafloor Classification with Neural Networks

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Duke University
Durham N.C. 27706

Abstract

A seafloor classification methodology, based on a parametrization of the reverberation probability density function in conjunction with neural net classifiers, is evaluated through computer simulations. Different seafloor "provinces" are represented by a number of scatterer distributions exhibiting various degrees of departure from the nominal Poisson distribution. Using the computer simulation program REVGEN/SST, these distributions were insonified at different spatial scales by varying the transmitted pulse length. The statistical signature obtained consists of reverberation kurtosis and coherent component estimates as a function of pulse length. The adaptive neural network algorithms are trained through supervised learning to recognize each statistical pattern and are presented with the task of discriminating among the various scatterer distributions. The initial results indicate that this approach offers considerable promise for practical, realizable solutions to the problem of remote seafloor classification.

Introduction

The scattering of sound by the ocean seafloor is a complex process, owing to the diversity of ocean floor types, lateral inhomogeneity and potential contribution of sub-bottom layers. Consequently, the theoretical treatment of bottom reverberation poses a formidable analytical problem. Two complementary approaches have evolved. The first is the so called "physical" method, whereby a solution of the wave equation is sought with appropriate boundary conditions describing the surface. Typically, the Helmholtz formula with the Kirchoff approximation is used. This method may be used to relate certain statistics of the random surface to the scattered acoustic field [1]. However, its usefulness is somewhat limited by the restrictive assumptions it is based on.

An alternative approach is to describe reverberation as a random process, constructed by a linear superposition of the individual echoes emanating from a large number of point reflectors distributed independently in a homogeneous medium. This is known as the "point-scattering" or "quasi-phenomenological" model of reverberation [2]. This model is quite general and allows the estimation of a large number of statistical measures of reverberation. However, these statistics are only weakly connected with the physical characteristics of the scattering region. Supporting "ground truth" data are needed to help establish this connection.

The weak physical connection of the point scattering model provided impetus for the work presented here. The model points towards different parametrizations of reverberation but fitting the model to data is not immediately meaningful. We propose to use these parametrizations in conjunction with a pattern recognition methodology to achieve seafloor classification. The basic idea is the following: Use the parameters prescribed by the model to create acoustic "signatures" representing a number of different seafloor types. The assumption is made that these types belong to distinct geologic provinces, verified by supporting ground truth data. It is envisioned that acoustic reverberation data are collected from each seafloor type and the salient acoustic parameters are extracted. A pattern recognition algorithm is then trained to recognize the prevailing seafloor type based on its acoustic signature. At this point, the sonar/algorithm combination should be capable of exploring uncharted regions and classifying the seafloor in terms of the known set of seafloor types.

Artificial neural net models ([3, 4]) have good potential for solving pattern recognition problems of this type, where many hypotheses are pursued in parallel. Neural net classifiers are non-parametric and thus more robust than traditional statistical classifiers that typically require knowledge of the underlying probability distributions. Moreover, they are adaptive and thus able to learn new patterns as they become available.

This paper begins with a parametrization of the reverberation probability density function (p.d.f.) offered by the point scattering model, in terms of the average number of scatterers contributing to the return and the presence of a coherent component embedded in the scattered return. This parametrization is subsequently applied to synthetic data created by a number of different scatterer distributions. A brief introduction to neural nets follows. The focus is on two particular neural net algorithms, a version of the linear perceptron and a semilinear feedforward net with backpropagation of error. Finally, these algorithms are presented with the task of discriminating among the different scatterer distributions based on the acoustic signature of each distribution.

The Point Scattering Model

The point scattering model treats reverberation as a random process resulting from the linear superposition of contributions from a large number of individual point scatterers:

$$x_r(t) = \sum_{i=1}^{n} a_i \, G(t_i) \, s(t - t_i)$$

where $s(t)$ is the transmitted signal, a_i are the stochastic amplitudes (acoustic cross sections), t_i are the stochastic

arrival times and n is the number of elementary signals contributing to the return. For a monostatic sonar,

$$G(t_i) = gB^2(r_i)f(t_i)$$

where g is a system gain factor, $B^2(r_i)$ is the two-way beam pattern factor in the direction of the i_{th} scatterer and $f(t_i)$ represents the two-way propagation loss.

A generalization of this model allows for a "coherent component" embedded in the scattered return. This "quasi-deterministic" component is defined as a harmonic process with a random phase. The composite reverberation return is given by

$$x(t) = x_r(t) + x_o$$

where $x_r(t)$ is the pure scattered return and x_o is the coherent component described by

$$x_o = Q\cos\theta$$

where Q is a constant and θ is uniformly distributed in $(-\pi, \pi)$. The p.d.f. of the composite reverberation return $x(t)$ normalized to unit variance, is given by [2]:

$$p(x) = \frac{1}{\pi\sqrt{2\pi}} \int_0^{\pi} \exp\left[-\frac{(x - Q\cos\theta)^2}{2}\right] \left\{1 + \frac{\gamma}{4!}\left[(x - Q\cos\theta)^4 - 6(x - Q\cos\theta)^2 + 3\right]\right\} d\theta$$

The quantity γ is known as the "coefficient of excess" or "kurtosis" and is defined by

$$\gamma = \left(\frac{\mu_4}{\sigma^4} - 3\right)$$

where μ_4 and σ^2 are the fourth central moment and the variance of x_r, respectively. The kurtosis γ can be related to the number of scatterers which combine to produce the reverberation process. As the number of scatterers increases, γ tends to zero. The coherent component Q represents intermittent coherent scattering that can result from specular components, occasional large targets or ordered scatterer distributions.

A Computer Experiment

The computer simulation program REVGEN/SST [5] has been used to produce synthetic reverberation data by insonifying various scatterer distributions with sound pulses of variable length. The best fit to the p.d.f. family defined above was obtained with the assistance of the Kolmogorov goodness-of-fit test. A detailed description of the computer experiment and the parameter estimation procedures can be found in [6]. The result of this process is an acoustic signature consisting of γ and Q values as a function of pulse length. Four scatterer distributions used in this computer experiment are shown in Figure 1. They are a Poisson (random) distribution (P1), a composite Poisson distribution (P2) and two clustered distributions (C1 and C2). The estimated γ and Q parameters for each distribution are shown in Figure 2. Each estimate is based on 30,000 samples of synthetic reverberation produced with REVGEN/SST. It can be seen that the four acoustic signatures differ significantly, reflecting the distinct character of each distribution. We intend to use these signatures as the basis of a pattern recognition scheme employing neural net algorithms.

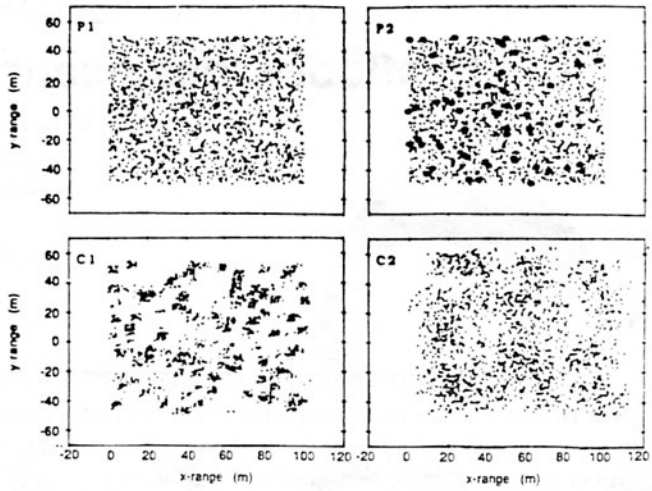

Figure 1: Scatterer distributions used in the computer experiment: Poisson (P1), composite Poisson (P2), heavily clustered (C1) and, mildly clustered (C2).

Neural Network Classifiers

Artificial neural systems are mathematical models of theorized mind and brain activity. The primary intent of artificial neural networks is to explore and reproduce human information processing tasks such as speech, vision, touch and knowledge processing. The neural net consists of a large number of interconnected computational elements which

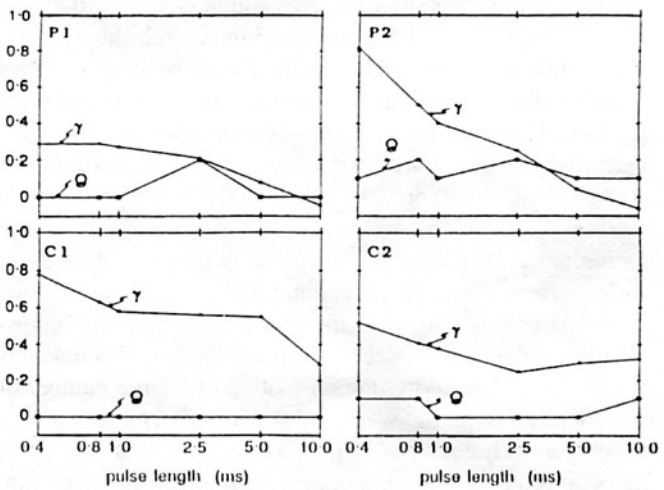

Figure 2: Acoustic signatures (γ and Q as a function of pulse length) corresponding to scatterer distributions P1, P2, C1 and C2. The pulse lengths are shown on a logarithmic scale.

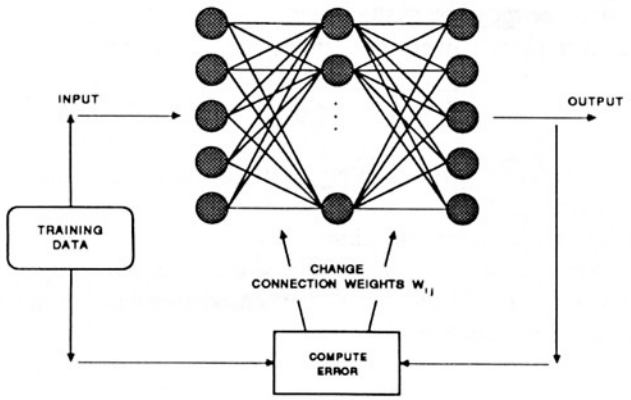

Figure 3: Schematic of a circuit for supervised learning: A supervisor outside the network compares the actual outputs of the network with the desired outputs and makes adjustments to the connections in the network.

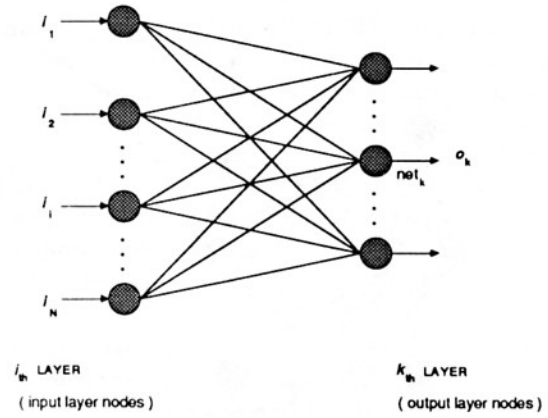

Figure 4: Network Representation of Multiclass Classification based on the Linear perceptron Algorithm.

model the behavior of neurons. In its simplest form, an artificial "neuron" is a threshold unit which accepts a number of inputs and produces an output only if the sum of the inputs exceeds an internal threshold. One of the most interesting aspects of neural networks is their learning capability. A neural network learns by adaptively changing the interconnection strengths between the neurons. In this way, a classifier can be built not by programming the network but by presenting it with a number of training examples and allowing it to build up the discriminant function automatically.

The schematic arrangement for supervised learning is shown in Figure 3. The network is presented with a set of training examples. For each example, the output of the network is compared with the desired output and adjustments are made to the interconnection strengths in the network. With a proper weight-adjustment algorithm, training produces a network that gives the correct input-output relations for the training data.

In the classification paradigm there is a fixed set of categories (classes) into which the stimulus patterns are to be classified. During the training session, the system is presented with the stimulus patterns along with the categories to which each stimulus belongs. The goal of this session is to learn correctly the stimuli so that in the future, when a particular pattern or a slightly distorted version of one of the stimuli is presented, the system will classify it properly [7].

The Linear Perceptron Algorithm

A classic algorithm which can implement the classification paradigm is the perceptron algorithm, initially developed by Rosenblatt [8] in 1962. A neural network representation of the perceptron algorithm for a multiclass classification is given in Figure 4. It is a two-layer associative network in which a set of input patterns arriving at an input layer are mapped directly to a set of output patterns at an output layer.

The decision function of the perceptron is based on the two-class problem: ω_i and ω_i', where ω_i' denotes all classes except ω_i. This net assumes that the decision function of the node which corresponds to the input pattern is greater than the decision function of all the other nodes:

$$\text{if } x \in \omega_i \Leftrightarrow d_i(x) \; d_j(x) \text{ for all } j \neq i$$

Weight adjustments are made according to the reinforcement learning algorithm. The algorithm penalizes the weights of the wrong node and rewards the weights of the correct node until the decision function of the correct node satisfies the above condition. During the learning phase, the weights of each node are examined at each iteration and adjusted as follows:

- If the examined node is correct on the input pattern the weights are not changed.
- If there is a node in the net whose decision function is greater than the correct node then:

1. Increase the weights corresponding to the correct class on all active lines by an amount c times the input pattern:

$$w_i(k+1) = w_i(k) + cx(k)$$

2. Decrease the weights corresponding to the wrong class on all active lines by an amount c times the input pattern:

$$w_l(k+1) = w_l(k) - cx(k)$$

3. Leave the weights in all other nodes unchanged:

$$w_j(k+1) = w_j(k)$$

It has been shown that the perceptron algorithm converges in a finite number of iterations only if the classes under consideration are linearly separable [9]. The reinforced learning results in faster convergence than the classic (reward only) perceptron algorithm. However, it is more sensitive to the

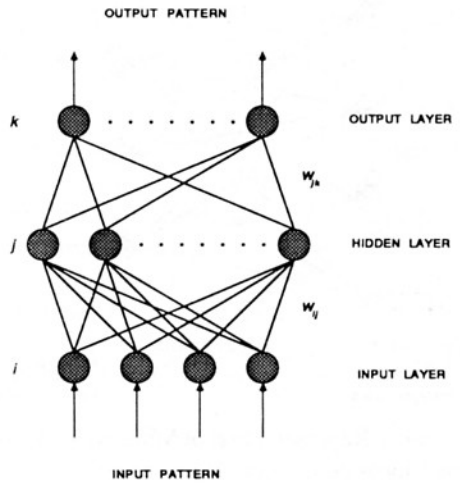

Figure 5: Schematic Depiction of Semilinear Feedforward Net with Backpropagation of Error.

amount of adjustment made at each step (the correction increment constant c) and it may oscillate around the convergence value.

The Semilinear Feedforward Net with Back-propagation of Error

The semilinear feedforward net as reported by Rumelhart, Hinton, and Williams [10] is similar to the architecture of the perceptron except for the presence of hidden layers of nodes. This network has greater ability to acquire arbitrary complex non-linear mappings and to generalize from given data than the perceptron. The net as shown in Figure 5 is made up of sets of nodes arranged in layers. The outputs of nodes in one layer are transmitted to nodes in another layer through links that amplify, attenuate or inhibit the outputs through weighting factors. Except for the input layer nodes, the net input to a node k is the sum of the weighted outputs of the nodes in the prior layer:

$$\text{net}_k = \sum_{\text{all } j} w_{kj}\, o_j$$

The activity of each node is determined by its input and its activation function together with an associated bias term. Thus, the output of node j is

$$o_j = f(\text{net}_j)$$

where f is the activation function. For a sigmoidal activation function,

$$o_j = \frac{1}{1 + e^{-(net_j + \theta_j)/\theta_o}}$$

where θ_j is the bias term.

The learning procedure is as follows: The net starts off with a random set of weight values. One of the training set patterns p is chosen. Using this pattern as input, the outputs are evaluated in a feedforward manner. In general, the outputs o_{pk} will not be the same as the target values t_{pk}. For each pattern, the average system error is defined by

$$E = \frac{1}{2P} \sum_p \sum_k (t_{pk} - o_{pk})^2$$

Initially, the errors will generally be quite large; this will necessitate changing the weights. The correction to the weights are made by taking incremental changes (Δw_{ji}) proportional to $-\vartheta E/\vartheta w_{ji}$ as follows: Using the backpropagation procedure [4], the net calculates $\Delta_p w_{ji}$ for all the w_{ji} in the net for that particular p, where

$$\Delta_p w_{ji} = \eta \delta_j o_j$$
$$\delta_j = -\frac{\vartheta E}{\vartheta\, net_j}$$

and η is a constant. This procedure is repeated for all the patterns in the training set to yield the resulting Δw_{ji} for all the weights for that one iteration; that is,

$$\Delta w_{ji} = \sum_p \Delta_p w_{ji}$$

After complete presentation of all patterns in the training set, a new set of weights is obtained and new outputs are again evaluated in a forward manner. In a successful learning exercise, the system error will decrease with the number of iterations, and the procedure will converge to a stable set of weights. These weights will exhibit only small fluctuations in value as further learning is attempted.

Performance Analysis

In this section, the acoustic signatures of Figure 2 are used in conjunction with the neural net structures described above to implement a classification scheme for the four chosen scatterer distributions (Figure 1). In order to limit the computational cost imposed by the large number of input patterns needed for algorithm training and testing, only the γ portion of the acoustic signature is used. The two algorithms were trained through supervised learning to recognize each input pattern correctly. Following the training phase, additional

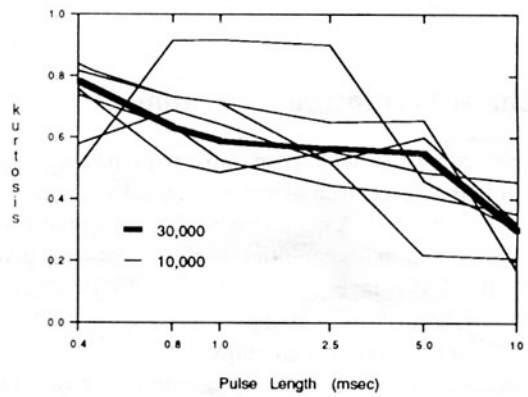

Figure 6: Example of "noisy" test patterns (corresponding to distribution C1) as compared to the training pattern (bold line).

CLASS	INPUT PATTERN	PERCEPTRON	BACKPROPAGATION
P1	1	● C2	P1
	2	P1	P1
	3	P1	P1
	4	P1	P1
	5	● C2	P1
	6	● C2	● C2
P2	1	P2	P2
	2	P2	P2
	3	P2	P2
	4	P2	P2
	5	P2	P2
	6	● C1	● C1
C1	1	C1	C1
	2	C1	C1
	3	C1	C1
	4	C1	C1
	5	C1	C1
	6	C1	C1
C2	1	C2	C2
	2	C2	C2
	3	C2	C2
	4	C2	C2
	5	C2	C2
	6	C2	C2
PERCENTAGE OF SUCCESS		83 %	92 %

Table 1: Simulation results for the two networks (dotted entries correspond to misclassification).

patterns of γ were produced from additional synthetic reverberation data. For the testing phase, the γ estimates were estimated from only 10,000 samples of synthetic reverberation. The reasoning for doing this is twofold. First, it was desired to produce a reasonably extensive set of input patterns. Second, in real-life, corrupted or noisy patterns are typically available. This "noisiness" is represented by the higher variance of the γ signatures as compared to the corresponding training pattern which was estimated from 30,000 samples (Figure 6).

Six new input patterns were produced for each distribution type. Each new pattern was classified by the trained algorithm into one of the four scatterer classes. The performance of the two neural nets is summarized in Table 1. The perceptron network converged during the learning mode after 8 iterations, while the feedforward net converged after 149 iterations. This significant difference is due to the lower architecture complexity of the perceptron network, as well as the simplicity of the reinforcement learning mechanism compared to the backpropagation of error learning mechanism. The nonlinearity of the input patterns resulted in the lower success rate (83%) for the perceptron network. Different network configurations for the feedforward net were tested. It was determined that one hidden layer with 4 nodes was the simplest network configuration to achieve the maximum success rate of 92%. Larger numbers of hidden layers and nodes resulted in slower convergence but did not improve the success rate.

Summary

A novel method for seafloor classification was tested through computer simulations. Synthetic reverberation data were created with four different scatterer distributions. Acoustic signatures were obtained based on a parametrization of the reverberation p.d.f. offered by the point scattering model. The acoustic signatures were used to train two neural net classifiers. Following the training phase, the algorithms were tested with six additional noisy input patterns for each distribution type. The linear perceptron correctly identified the prevailing distribution for 83% of the test patterns. The backpropagation algorithm had a success rate of 92%. Continued study of this approach is needed to evaluate its potential usefulness in the field.

Acknowledgements

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OCEANIC ENGINEERING SOCIETY

PLEASE REPLY TO:

Norman D. Miller, P.E.
Vice President, West
West Sound Associates, Inc.
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(206) 373-9838
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Dear Colleague:

Last summer, the Society published a Membership Directory. We hope that you received your copy and have had a chance to look through it. One of the features of the directory was the publication of the Society's Constitution and Bylaws. If you have not already done so, I would suggest that you read them to gain an understanding of objectives and fields of interest of the Society. Article V of the Constitution defines how the society is governed and how the Administrative Committee (AdCom) is organized and operates.

At the present time, OES has two primary activities, Conferences and Publications. Each year, we sponsor the OCEANS conference. For the past two years, we have also sponsored a special conference on underwater vehicle technology. We have also sponsored workshops on current measurements and polar operations. We are planning a neural networks workshop for September 1991.

The Society's principal publication is the IEEE Journal of Oceanic Engineering. This, we believe, is a premier archival journal that provides articles on state-of-the-art as well as leading edge technology. The IEEE Oceanic Engineering Society Newsletter is intended to provide timely news on current activities of the society as well as articles of current scientific interest.

The AdCom is interested in knowing how OES can be of greater service to you, and would appreciate some feedback from you on the enclosed questionnaire. Specifically, are you satisfied with the services that OES is providing, or are there additional functions or activities that you consider important that the Society should be pursuing? Please feel free to criticize as well as complement. By hearing from you, we can better understand what the membership expects from the Society.

Thank you for your prompt return of the enclosed questionnaire.

Sincerely,

Norman D. Miller

Norman D. Miller, P.E.

Enclosure

OES INTEREST QUESTIONNAIRE

	Yes	No
1. Are you employed in some phase of ocean engineering or science?		

2. What is your primary occupational field or specialty?

3. OES has eight Technical Committees. Are you working in any of these fields of interest? (Check as many as apply):

_____ Underwater Acoustics Technology
_____ Arctic Instrumentation
_____ Autonomous Underwater Vehicle Technology
_____ Current Measurement Technology
_____ Marine Communication and Navigation Technology
_____ Modeling, Simulation, and Data Base Technology
_____ Oceanographic Instrumentation and Data Acquisition Technology
_____ Remote Sensors Technology and Applications

	Yes	No
4. Would you be interested in serving on one of the above mentioned committees?		

	Yes	No
5. Have you attended an OCEANS Conference in the past five years?		

___ OCEANS '87 ___ OCEANS '88 ___ OCEANS '89 ___ OCEANS '90

	Yes	No
6. Have you attended any of the OES sponsored specialty conferences or workshops such as the Autonomous Vehicle Conference, Polar Workshop, or Current Measurements Workshop?		

	Yes	No
7. Have you presented a paper at any of the above Conferences?		

8. What other ocean engineering or science related conference/workshop would you like to see sponsored by OES?

9. How useful is the IEEE Journal of Oceanic Engineering to you:

____Read ____Scan ____Read Selected Articles ____Retain ____Don't Read

Comments:

	Yes	No
10. Do you find the IEEE Oceanic Engineering Society Newsletter of interest?		

____Read Completely ____Scan ____Read Selected Articles ____Don't Read

Comments:

	Yes	No
11. Have you submitted material for publication in the above?		
12. Do you desire information on submitting material for publication?		

13. How can OES be of benefit to you?

For example, would you be interested in:

	Yes	No
a. More information about OES activities?		
b. Receiving notification of conferences and workshops?		
c. Receiving information on the OES Chapters in your area?		

d. Other? (Specify)

14. OES needs active volunteer workers.

Would you be willing to:

	Yes	No
a. Serve on a Technical Committee?		
b. Help with a Conference or Workshop?		
c. Review technical papers for the Journal?		
d. Serve on the OES Administrative Committee?		

15. Comments about OES:

THANK YOU FOR YOUR PARTICIPATION!

Name _____

Address _____

City,State,Zip _____

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James A. Watson, Editor—Georgia C. Stelluto, Associate Editor

IEEE-USA Volunteers Meet With Government, Industry Leaders to Enhance U.S. Competitiveness

1990 IEEE President Carleton A. Bayless, USAB Chairman Michael J. Whitelaw, and members of IEEE-USA's National Government Activities Committee, including Committee Chairman Edward C. Bertnolli, held a ***Colloquium on IEEE-USA's Legislative Initiative on U.S. Competitiveness and Pension Portability*** on October 19-20 with government and industry leaders in Washington, D.C. The meeting promoted U.S. technological competitiveness and supported expansion of long-term savings programs. IEEE-USA volunteers and staff made presentations on activities in progress supporting the Legislative Initiative. Experts critiqued IEEE-USA's present efforts and made suggestions for the future.

Conferring with Robert M. White, U.S. Department of Commerce Under Secretary for Technology and other invited speakers, IEEE-USA representatives discussed what role the Federal Government should play in U.S. competitiveness. Participants agreed that U.S. manufacturing companies need to re-think strategies, designing programs geared toward total quality products with fewer defects. Such strategies will better enable the United States to compete in international markets.

Speakers pointed out that Japanese competitors use a "concurrent engineering" theory—designing products and manufacturing techniques at the same time—which has effectively enhanced their international competitive edge. Industry leaders present included Turner E. Hasty, Chief Operating Officer of SEMATECH, the consortium devoted to revitalizing U.S. chipmaking capabilities; Kent H. Hughes, President, Council on Competitiveness; J. Richard Iverson, President, American Electronics Association; and Barry J. Leffs, President, Peninsula Engineering Group, Inc.

IEEE United States Activities Board Approves Seven Entity Position Statements

The IEEE United States Activities Board approved the following position statements at its August 13 meeting:

- ***Computer Crime***—IEEE-USA supports comprehensive legislation defining and addressing crime against computer and communications-based information systems. The legislation must serve the creation and use of communications-based information systems, while preventing computer crime and misuse by irresponsible individuals.
- ***Human Exposure to Microwaves and Other Radio-Frequency Electromagnetic Fields***—IEEE-USA recognizes public concern over health hazards accompanying the expanding use of devices emitting microwaves and other radio-frequency electromagnetic (RFEM) fields. The American National Standards Institute (ANSI) has published guidelines for limiting exposure, developed by scientific and medical experts, to protect workers and members of the general public from harmful RFEM exposure. IEEE-USA supports these guidelines and also recognizes the need for continuing research to ensure the safe use of RFEM fields.
- ***Engineering Education in the United States***—IEEE-USA urges focusing attention on practice and design, providing a knowledge base and capability for career-long learning, practice-oriented graduate study programs, laboratory studies, career paths, global environment, teaching practicums, changing demographics and professional accreditation. An American Society for Engineering Education (ASEE) task force made recommendations to strengthen and improve engineering education in the United States in their report, "A National Action Agenda for Engineering Education," which IEEE-USA commends and supports.
- ***Photovoltaic Technology Development***—IEEE-USA recommends these actions to government, industry and consumers: increasing federal and state government support for photovoltaic research and development, with a goal toward large-scale PV development; creating and implementing a broad-based photovoltaic development strategy; and increasing public awareness of photovoltaic energy options.
- ***U.S. Technological Leadership and Engineering Employment***—IEEE-USA calls on Congress and the Administration to implement programs and policies leading to full employment of U.S. engineering manpower resources. Immediately responsive activity may include programs to retrain defense-oriented engineers to meet civilian needs and providing employer and educational institution incentives for such efforts.
- ***Biological Effects of Electric and Magnetic Fields from Video Display Terminals***—IEEE-USA recognizes the present public concern about possible health and reproductive side effects resulting from extensive use of video display terminals (VDTs). At present, there is no conclusive evidence that VDT electric and magnetic fields significantly influence the health of VDT operators. IEEE-USA will continue to study new scientific information concerning potential health effects associated with VDT use.
- ***Professional Practices for Engineers, Scientists and their Employers***—IEEE-USA provides employer and employee guidelines and techniques enhancing engineers' and scientists' career opportunities. The professional practices described are designed to increase U.S. productivity and enhance employer-employee relations in the working environment.

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IEEE-USA Engineering R&D Policy Committee Sponsors Symposium

IEEE-USA's Engineering R&D Policy Committee sponsored a symposium on ***Government Policymaking and Technological Competitiveness,*** December 3-4, in Washington, D.C., for members of the National Electrical Engineering Department Heads Association (NEEDHA). Executive policymaking processes, legislative initiatives, technological competitiveness, and IEEE-USA and the policy process were among the featured topics.

Keynote speakers were Congressman George Brown (D-California) and MIT Professor Michael Dertouzos, author of *Made in America*. Speakers from IEEE-USA's National Government Activities Committee, Engineering R&D Policy Committee and Technology Policy Council conducted discussions of IEEE-USA's initiatives. Also addressing the symposium were speakers from the National Science Foundation, The National Institute of Standards and Technology, and the Library of Congress. They briefed participants on Government processes and programs. For more information about the symposium, contact Chris Brantley at the IEEE-USA Office in Washington, D.C.

COMAR Advocates Increased Research

On behalf of IEEE-USA's Committee on Man and Radiation (COMAR), Chairman James C. Lin submitted a statement on the ***Potential Health Effects of Power Frequency Electromagnetic Radiation*** to the U.S. House of Representatives Subcommittee on Natural Resources, Agricultural Research, and Environment. Lin also wrote a letter to *Science* Magazine Editor Daniel Koshland in response to three articles on the biological effects of electric and magnetic fields that appeared in the magazine's September and October issues.

In the statement and subsequent letter, COMAR reported that scientific data is insufficient to establish whether exposure to power frequency electric and magnetic fields should be considered a health hazard. The Committee concludes that more research is needed to understand the problem and define safe and unsafe field levels and exposure durations.

With regard to research, COMAR called for increased investigation of interaction mechanisms and animal studies to ascertain causal relationships between power-frequency fields and health effects. The Committee also supported continued efforts in human health studies, but with greater emphasis on confounding factors and known cancer-causing agents. COMAR also noted that a measurement program to identify and characterize electric and magnetic field sources is essential before exposure mitigation procedures can be effectively implemented.

IEEE-USA Supports Revitalizing U.S. Academic Research Facilities

In a recent letter to President George Bush, USAB Chairman Michael J. Whitelaw endorsed Congress' request for Administration support for planning and investment to modernize the U.S. academic research infrastructure. "We share the growing concern that years of inadequate investment in research facilities and equipment is threatening the ability of colleges and universities to attract and educate scientists and engineers and perform the types of research needed to sustain the United States' technological edge," Whitelaw said.

National Science Foundation Acting Director Frederick M. Bernthal responded to Whitelaw's letter, on President Bush's behalf, saying a comprehensive approach for addressing this concern "will be given thorough consideration." Bernthal also noted that NSF is initiating a merit-based program to assist in modernizing and revitalizing U.S. research facilities.

IEEE Committee Organizes Competitiveness Workshop at AAES Conference

IEEE's Technology Policy Conference Committee, a joint committee of IEEE United States Activities and IEEE's Technical Activities Board, is organizing a workshop on U.S. competitiveness at the 1991 Engineering Societies Government Affairs Conference. Dr. Oscar Garcia chairs IEEE's joint committee. The Conference will take place on March 6, 1991 at the Madison Hotel in Washington, D.C. Sponsored by the American Association of Engineering Societies, the Conference is designed to introduce the professional engineering community to important issues facing the incoming 102nd Congress.

Dr. Robert White, Undersecretary for Technology in the Department of Commerce and an IEEE Fellow, will deliver one of the major presentations during the morning plenary session. He will address the Federal government's role in promoting U.S. competitiveness. Dr. Robert Frosch, Vice President for Research of General Motors Corporation and an IEEE Fellow, will moderate IEEE's afternoon Competitiveness Workshop. This session will include discussion by two panels of prominent industry and government spokesmen on actions needing to be taken by both the private and the public sectors to promote U.S. competitiveness.

The audience will include engineering society leaders, members of the engineering, science, and technology community, Congressional and Executive Office staff, and members of the media. For additional information or to obtain advance registration materials, please contact Chris Brantley at the IEEE-USA Office in Washington, D.C.

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IEEE-USA Aerospace R&D Policy Committee Comments on U.S. Space Program

Michael J. Whitelaw, 1991 USAB Chairman and IEEE Vice President of Professional Activities wrote a letter on behalf of IEEE-USA's Aerospace R&D Policy Committee to Vice President Dan Quayle, Chairman of the National Space Council. The letter responds to a public invitation Quayle issued to the aerospace community for fresh thoughts on the U.S. Space Program.

IEEE-USA made three recommendations related to the U.S. Civil Space Program. NASA should:

- Emphasize earth-oriented applications equally with manned space programs. Noting the pervasive public concern with environmental issues, IEEE-USA encouraged the United States and NASA to proceed with the earth observing system (EOS), its associated data information system (EOSDIS), and Mission to Planet Earth—a major component of the U.S. Global Change Research Program.
- Proceed prudently with a Moon-Mars program to explore the solar system; and
- Solicit private sector involvement and initiative in the civil space arena.

Whitelaw's letter suggested that if NASA followed these steps, civil space unit costs would drop and the Government could focus more on basic research and technology development, as well as conceive new ways to acquire space assets. Additionally, private activities in space would proliferate and private sector businesses and U.S. Government interaction would increase.

IEEE United States Activities Board Approves Entity Position Statement

IEEE's United States Activities Board approved a position statement on ***Animal Experimentation in Biomedical Research*** at its November 1990 meeting. The position states that IEEE-USA recognizes the major role that engineering plays in research intended to provide greater understanding of physiological processes, to treat or prevent diseases and disabilities, and to improve the participation of the disabled in society. IEEE-USA also realizes that the appropriate use of animals in properly conducted research has led to advancements in the health sciences that have improved the quality and duration of human life.

Accordingly, IEEE-USA supports using animals in health care research, provided studies are conducted in a humane manner and within legal guidelines. Using alternative methods of research, such as computer modeling, are encouraged where applicable.

How to Understand Your Pension Plan

IEEE-USA's Pensions Committee has assembled an informative chartbook, *Understanding Pensions,* as an educational service to IEEE's U.S. members. Information about the chartbook has been distributed to the PACE Chairman in each IEEE U.S. Section. To make the most effective use of this resource, the Pensions Committee recommends that PACE representatives sponsor 25- to 35-minute presentations on pensions as a PACE project at Section meetings. IEEE-USA Pensions Committee members are available to assist by preparing and delivering such presentations.

Understanding Pensions is not just for those soon to retire. The chartbook is for everyone who wants to begin planning ahead for a more financially secure retirement. Few employee benefit programs are more important than pensions, because the amount of an individual's pension, along with Social Security and personal savings, will determine one's standard of living during retirement years. And since the accumulation of retirement income takes a considerable period of time, it's very important that today's increasingly mobile workers learn as much as they can, as soon as they can, about how pensions work.

The Chartbook was designed for use by engineers, scientists, and other professionals who want to learn more about pensions and how the nation's voluntary private pension system operates. *Understanding Pensions* contains 58 visuals, each accompanied by text containing basic factual information, informed opinion, and practical advice. Copies of the chartbook are available on request from the IEEE-USA Office in Washington, D.C.

Updated Career Guidance Brochure Now Available

IEEE-USA has revised and updated a career guidance brochure, *Your Career in the Electrical, Electronics, and Computer Engineering Fields.* The brochure is distributed to high school and college students who are interested in exploring careers in electrical, electronics, or computer engineering. Copies also are sent to high school counselors, libraries, career counseling centers, and other interested institutions and individuals.

IEEE members may obtain up to 25 copies free of charge for distribution at local student events by contacting the IEEE-USA Office in Washington, D.C. If more than 25 copies are required for a single event, the balance must be purchased at $0.75 each. Individual copies are available free.

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IEEE-USA Supports Appointment of Biomedical Engineers

IEEE Vice President of Professional Activities Michael J. Whitelaw wrote a letter on behalf of IEEE-USA's Health Care Engineering Policy Committee (HCEPC) to U.S. Secretary of Health and Human Services Louis W. Sullivan, M.D. In the letter, Whitelaw expressed surprise that no biomedical or clinical engineers had been appointed to the National Advisory Council for Health Care Policy, Research and Evaluation. Whitelaw urged the Secretary to make such an appointment when the next opportunity arises. He stressed that HCEPC would be happy to provide resumes of candidates for future appointments to the National Advisory Council. The Committee was established "to assist in the national formulation of health care legislation, regulation, and policy in the United States," Whitelaw said.

IEEE-USA Lobbies Successfully for Landmark Legislation

IEEE-USA's Anti-Discrimination Committee effectively lobbied Congress for passage of *S.1511*, the ***Older Workers' Benefit Protection Act.*** President Bush signed the legislation in October 1990.

The Committee's efforts contributed to this legislation overturning a 1989 Supreme Court ruling, ***Ohio v. Betts,*** in which a state employee was denied a particular employment benefit because of age. The legislation, however, now makes virtually all forms of age discrimination in employee benefits unlawful. The law will also ensure that older workers will not be coerced or manipulated into waiving their rights to seek legal relief under the ***Age Discrimination in Employment Act.***

IEEE-USA's Committee and TAB Society Conduct Symposium

IEEE-USA's Health Care Engineering Policy Committee conducted a symposium in November 1990, in conjunction with the Engineering in Medicine and Biology Society's (EMBS) annual biomedical engineering conference in Philadelphia, PA.

The purpose of this special session was to help the participants broaden their understanding of the increasingly competitive nature of the evolving global market confronting the U.S. medical device industry.

Speakers included Joel Nobel of the Emergency Care Research Institute; Alvin Wald, Columbia-Presbyterian Medical Center; Mathew Gallivan, Health Industry Manufacturers Association; Elizabeth Jacobsen, Federal Drug Administration; and Catherine Vial of the U.S. Department of Commerce. They covered a wide range of topics, such as international standards, product quality, U.S. trade and regulatory policy, and challenges presented by the 1992 European community market.

1990 IEEE-USA Congressional Fellows Submit Final Report

IEEE-USA's 1990 Congressional Fellows Phillip Paterno and Alfred Victor recently submitted final reports summarizing their activities and accomplishments during their year in Congress.

Paterno had selected a position on the personal staff of Rep. Don Ritter (R-Pennsylvania). In his report, Paterno said he spent most of his Congressional year working on competitiveness, high resolution systems, and quality issues. As part of a package of competitiveness proposals, Paterno worked on developing two bills that would amend the Internal Revenue Code of 1986 to provide an indexed variable capital gains deduction and investment tax credits for new manufacturing equipment.

He also prepared press releases, wrote speeches and attended hearings. "I realize now how naive I was when it came to politics and the political process. . . . that has changed since becoming a Fellow," Paterno said.

Alfred Victor spent his year as a staff member of the House Subcommittee on Science, Research and Technology (SRT); of the Committee on Science, Space and Technology. His work was associated with competitiveness and technology transfer issues. Victor reported that he prepared for and attended hearings and assisted with writing legislation.

In his report, Victor commented that IEEE-USA's Congressional Fellowship Program is "invaluable, not only to the individual, but also to the Congress and the sponsoring organizations."

Glossary of Supercomputing Terms is Updated

IEEE-USA's Scientific Supercomputer Subcommittee of the Committee on Communications and Information Policy recently published the 2nd edition of ***Supercomputing: An Informal Glossary of Terms.*** The information is intended to help both novices and experts communicate better and to provide a foundation for developing more definitions.

The 24-page, second edition of the ***Glossary*** may be purchased through the IEEE Service Center, 445 Hoes Lane, P.O. Box 1331, Piscataway, New Jersey 08855-1331; telephone 1 (800) 678-IEEE or (201) 981-1393. Ask for IEEE Catalog No. UH0182-6; prices are $7.50 for members and $9.95 for non-members.

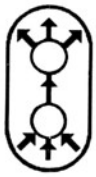
IEEE-USA's Annual Report Now Available

The **1990 Annual Report of IEEE United States Activities** is now available. "A Year in Pictures" highlights some of the successes made in U.S. professional activities during the year. For copies, contact Public Relations at the IEEE-USA Office in Washington, D.C.

CONFERENCE ON NEURAL NETWORKS FOR OCEAN ENGINEERING

WASHINGTON D.C. AUGUST 15-17, 1991

The Conference on Neural Networks for Ocean Engineering, (CNNOE), is sponsored by the IEEE Ocean Engineering Society in cooperation with the IEEE Neural Networks Council. Neural networks are having a very large impact on several aspects of the ocean engineering environment in areas such as passive transient sonar signal classification, low-frequency active acoustic sonar signal processing, ocean surveillance, adaptive beamforming, underwater acoustic communication, and many more. **This conference will, for the first time, bring the international community together in one meeting to discuss these significant advances.**



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Co-Chair:	Ferial El-Hawary, Tech. Univ. of Nova Scotia
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PROGRAM COMMITTEE

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GENERAL INFORMATION

CONFERENCE SETTING

The Conference on Neural Networks for Ocean Engineering will be held August 15-17, 1991, at the Loews L'enfant Plaza, in Washington, D.C. Further information regarding room reservations will be published in a later brochure.

REGISTRATION FEES

A discount is allowed to all current IEEE members. Member I.D. Number is required. This discount does not apply to tutorials.

IEEE Member Registration Fees:

Before May 1, 1991	$135
Before July 1, 1991	$185
Before August 9, 1991	$240
Student	$60

Non-Member Registration Fees:

Before May 1, 1991	$190
Before July 1, 1991	$245
Before August 9, 1991	$300
Student	$120

TUTORIAL REGISTRATION FEES

Only registered conference participants may register for the tutorials.

One Tutorial	$150
Two Tutorials	$250

FURTHER INFORMATION

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