Dr. Pradip Ghanty

Contact Information

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Research Interests

Computational Intelligence, Neural Networks, Support Vector Machines, Hybrid System, Feature Selection, Bioinformatics, Image Processing, Thermal Image Analysis

Papers Taught in UG Course

Programming in C, Data Structure, DBMS, Object Oriented Programming, Formal Language, Compiler Design, Microprocessor, Computer Organization, Software Engineering

Papers Taught in PG Course

Data Structure, Theory of Computation, Advanced DBMS, Object Oriented Programming, COBOL

Education

Doctor of Philosophy (Ph.D.) in Engineering, **Dec 2007 - July 2015**

Jadavpur University, Kolkata, India

- Specialization: Computational Intelligence and Bioinformatics
- The work was carried out in the Electronics and Communication Sciences Unit at Indian Statistcal Institute, Kolkata, India.

Master of Computer Application (First class with Distinction) **1999 - 2002**

Visva-Bharati, Santiniketan, India

- Specialization: Image Processing and Compiler Construction

Post Graduate Diploma in Computer Science and Applications (First Class with Honours) **1997 - 1998**

The University of Burdwan, Burdwan, India

Bachelor of Science, Mathematics Honours (Second Division) **1993 - 1996**

The University of Burdwan, Burdwan, India

Higher Secondary (First Division) **1991 - 1993**

West Bengal Council of Higher Secondary Education.

Secondary (First Division) **1989 - 1991**

West Bengal Board of Secondary Education.

Honors and Awards

- Member of Under Graduate Board of Studies in Computer Science and Bachelor of Computer Application of Kazi Nazrul Uinveristy.
- Member of Syllabus Committee in Computer Science and Bachelor of Computer Application of Kazi Nazrul Uinveristy.

- Received research fellowship from Dept. of Atomic Energy, Govt. of India, India in April, 2005 - June, 2008.
- Received merit scholarship from Visva-Bharati in 2000-2002.
- Reviewer for various International Journals and Conferences.
- Microsoft Certified Technology Specialist (MCTS): Microsoft Office SharePoint Server 2007 - Application Development.
- Member of Institute of Electrical and Electronics Engineers (IEEE).
- Member of Association for Computing Machinery (ACM).

Research Experience in Academia

Indian Statistical Institute, Kolkata
Project-linked Senior Research Fellow
Guide: Professor Nikhil R Pal and Dipti P Mukherjee

Computational Intelligence Based Remote Welding System **April, 2005 - June, 2008**
Area of application: Thermal Image Analysis, Image Segmentation, Neural Networks and Fuzzy Rule Base

- Project has two phases. In the first phase, prediction systems using *neural networks and fuzzy logic* have been developed. The following phase is being developed for the advisory system. The advisory system will be used for estimating the weld control parameters from a given set of weld bead geometry features. The sub phase of advisory system has been developed for estimating weld bead geometry features from the weld *infrared thermal images*. *Image processing techniques and machine learning tools* have been used for estimating weld bead geometry features.
- We analyze the importance of different weld control parameters on the weld pool geometry of gas tungsten arc welding using an *online feature selection technique* that suggests weld voltage and vertexangle pair as more important than the weld voltage and torch speed pair. Using the selected features *multilayer perceptron* and *radial basis function networks* are developed for prediction of bead width, penetration depth, and bead area. The performance of the proposed models is found to be quite satisfactory. (see publication 1.h).
- The use of *fuzzy rule based* systems to model the relationship between weld control parameters and the weld bead geometry features is explored in this study. The system parameters, e.g. consequent parameters, are estimated using a mixture of least square error (LSE) method and gradient search. The system is tested on three datasets and the performance is found to be satisfactory compared to the multilayer perceptron (MLP) and radial basis function (RBF) neural networks based systems. (see publication 1.g).
- We have proposed an *artificial neural network* based system to predict weld bead geometry using features derived from the *infrared thermal video* of a welding process. The *multilayer perceptron* and *radial basis function networks* are used in the prediction model and an *online feature selection technique* priorities the features used in the prediction model. The efficacy of the system is demonstrated with a number of welding experiments and using the leave one out cross-validation experiments. (see publication 1.f).

Research Scientist
Guide: Professor Nikhil R Pal and Professor Rajani K Mudi

Computational Intelligence Based Methods for Some Bioinformatics Problems **(December, 2007 - June, 2014)**

Area of application: Probability Based Features, Neural Networks, Support Vector Machines, Hybrid System, Feature Selection Neural Networks, Statistical Tests, PCA and Bioinformatics

- We propose a new multilayer classifier architecture. The proposed hybrid architecture has two cascaded modules: feature extraction module and classification module. In the feature extraction module we use the *multilayered perceptron (MLP)* neural networks, although other tools such as radial basis function (RBF) networks can be used. In the classification module we use *support vector machines* (SVMs) - here also other tool such as MLP or RBF can be used. The feature extraction module has several sub-modules each of which is expected to extract features capturing the discriminating characteristics of different areas of the input space. The classification module classifies the data based on the extracted features. The resultant architecture with MLP in feature extraction module and SVM in classification module is called NEUROSVM. The NEUROSVM is tested on twelve benchmark data sets and the performance of the NEUROSVM is found to be better than both MLP and SVM. We also compare the performance of proposed architecture with that of two ensemble methods: majority voting and averaging. Here also the NEUROSVM is found to perform better than these two ensemble methods. Further we explore the use of MLP and RBF in the classification module of the proposed architecture. The most attractive feature of NEUROSVM is that it practically eliminates the severe dependency of SVM on the choice of kernel. This has been verified with respect to both *linear and non-linear kernels*. (see publication 1.d).

- For prediction of protein secondary structure, we propose some co-occurrence probability-based features. The features are extracted using occurrence/non-occurrence of secondary structures in the protein sequences. We explore two types of features: position-specific (based on position of amino acid on fragments of protein sequences) as well as position-independent (independent of amino acid position on fragments of protein sequences). As stated earlier, we use our proposed hybrid system, NEUROSVM, consisting of neural networks and support vector machines for classification of secondary structures. We propose two schemes NSVMps and NSVM for protein secondary structure prediction. The NSVMps uses position-specific probability-based features and NEUROSVM classifier whereas NSVM uses the same classifier with position-independent probability-based features. The results obtained using the proposed features and NEUROSVM classifier are better than most of the existing single-sequence prediction methods. (see publication 1.b).

- Protein fold determination is the problem of finding the 3D structure of a protein from its amino acid sequences. There are two levels of classification of proteins: four structural classes (level 1) and twenty-seven folds (level 2). Three machine learning tools, *multilayer perceptron (MLP), radial basis function (RBF) and support vector machines (SVMs)*, are used for both level of classifications. (see publication 1.c).

- We have also addressed a biomarkers identification problem from protein expression for Alzheimer disease diagnosis. As the brain controls many body functions via releasing signalling proteins through blood, we opted for analyzing blood plasma proteins for diagnosis of Alzheimer's disease. In this study we have proposed a *Radial Basis Function (RBF) neural network* based *feature selection scheme* for selection of plasma signalling proteins that can help in clinical Alzheimer's diagnosis. We have found a set of plasma proteins less in number than previous study with comparable prediction accuracy. We have also investigated the Mild Cognitive Impairment (MCI) samples with our selected plasma signalling proteins. We have used *neural networks* and *Support Vector Machines (SVM)* as classification tools. The *principle component analysis (PCA)*, Sammmon mapping, heat-map along with dendrogram of selected plasma signalling proteins have been used to see their discriminating power to aid in Alzheimer's diagnosis. (see publication 1.a).

Research Scientist

Guide: Professor Swapan K Parui

SVM-based hierarchical architectures for handwritten Bangla character recognition **November, 2008 - June, 2009**
Area of application: Optical character recognition (OCR), Wavelet transform, Clustering, Neural Networks, Support Vector Machines, Hierarchical learning architectures

- We propose support vector machine (SVM) based hierarchical classification schemes for recognition of handwritten Bangla characters. A comparative study is made among multilayer perceptron, radial basis function network and SVM classifier for this 45 class recognition problem. SVM classifier is found to outperform the other classifiers. Afusion scheme using the three classifiers is proposed which is marginally better than SVM classifier. It is observed that there are groups of characters having similar shapes. These groups are determined in two different ways on the basis of the confusion matrix obtained from SVM classifier. In the former, the groups are disjoint while they are overlapped in the latter. Another grouping scheme is proposed based on the confusionmatrix obtained from neural gas algorithm. Groups are disjoint here. Three different two-stage hierarchical learning architectures (HLAs) are proposed using the three grouping schemes. An unknown character image is classified into a group in the first stage. The second stage recognizes the class within this group. Performances of the HLA schemes are found to be better than single stage classification schemes. (see publication 1.e).

Research Experience in Industry

Avant Garde Software Pvt. Ltd., Kolkata, India **July, 2014 - November, 2016**
Tech Lead - Development
I have worked as a consultant for different projects. My roles and responsibilities are system design, leading a team, and software development.

Praxis Softek Solutions Pvt. Ltd., Kolkata, India **June, 2008 - July, 2014**
Senior System Engineer
I have worked as a consultant for different projects. My roles and responsibilities are system design and software development.

Journal Publications

1.a) Swapna Agarwal, Pradip Ghanty and Nikhil R Pal, *Prediction of Alzheimer's Disease using minimal set of plasma signalling proteins selected by Feature Selection Radial Basis Function Neural Network*, Bioinformatics, vol. 31, no. 15, August 2015, pp. 2505-2513.

1.b) Pradip Ghanty, Nikhil R Pal and Rajani K Mudi, *Prediction of Protein Secondary Structure using Probability Based Features and a Hybrid System*, Journal of Bioinformatics and Computational Biology, vol. 11, no. 5, October 2013, Article ID: 1350012.

1.c) Pradip Ghanty and Nikhil R Pal, *Prediction of Protein Folds: Extraction of New Features, Dimensionality Reduction, and Fusion of Heterogeneous Classifiers*, IEEE Transactions on Nanobioscience, vol. 8, no.1, March 2009, pp.100-110.

1.d) Pradip Ghanty, Samrat Paul and Nikhil R Pal, *NEUROSVM: An Architecture to Reduce the Effect of the Choice of Kernel on the Performance of SVM*, Journal of Machine Learning Research, vol. 10, March 2009, pp.591-622.

1.e) Tapan Kumar Bhowmik, Pradip Ghanty, Anandarup Roy and Swapan Kumar Parui, *SVM-based hierarchical architectures for handwritten Bangla character recognition*, Int. Journal of Document Analysis and Recognition (IJDAR), vol. 12, no. 2, July 2009, pp.97-108.

1.f) P. Ghanty, M. Vasudevan, D.P. Mukherjee, N.R. Pal, N. Chandrasekhar, V. Maduraimuthu, A.K. Bhaduri, P. Barat and B. Raj, *Artificial Neural Network Approach for Estimating Weld*

Bead Width and Depth of Penetration from Infrared Thermal Image of Weld Pool, Science and Technology of Welding and Joining, vol. 13, no. 4, July 2008, pp.395-401.

1.g) P. Ghanty, S. Paul, A. Roy, D.P. Mukherjee, N.R. Pal, M. Vasudevan, H. Kumar and A.K. Bhaduri, *Fuzzy Rule Based Approach for Predicting Weld Bead Geometry in Gas Tungsten Arc Welding*, Science and Technology of Welding and Joining, vol. 13, no. 2, March 2008, pp.167-175.

1.h) P. Ghanty, S. Paul, D.P. Mukherjee, N.R. Pal, M. Vasudevan, and A.K. Bhaduri, *Modelling Weld Bead Geometry Using Neural Networks for GTAW of Austenitic Stainless Steel*, Science and Technology of Welding and Joining, vol. 12, no. 7, Oct 2007, pp. 649-658.

Teaching Experience in Academia

Working as **Assistant Professor in Computer Science**, Asansol Girls' College, Asansol since December, 2016.

Worked as a **Lecturer in Computer Applications** to teach different subjects as a part of the **Bachelor of Computer Science (Hons.) and Bachelor of Computer Application** program at the Asansol Girls' College, Asansol, India. (from September, 2002 to April, 2005)

Invited as a **Guest Lecturer** to teach the subjects **Computer Graphics, Database Management and Data Structure** as a part of the **Master of Computer Application** program at the Visva-Bharati, Santiniketan, India. (Different semesters in between 2002 to 2006)

Invited as a **Guest Lecturer** to teach the subject **Data Structure** as a part of the **Bachelor of Computer Application** program at the B. B. College, Asansol, India. (2003-2004)

Other Notable Input

- Have International and National conference publications beside above journal publications.
- Worked as Convener of BCA Practical Examinations of Kazi Nazrul University.
- Worked as External Practical Examiner for UG Examinations of Kazi Nazrul University, Burdwan University and Visva-Bharati.
- Worked as External Practical Examiner for ISC Computer Examination.
- Worked as Moderator for UG Examinations of Kazi Nazrul University.
- Supervised student projects at Asansol Girls' College.
- Delivered talk in North-East Workshop organized by Electronics and Communication Sciences Unit, Indian Statistical Institute in 2007.
- Training imparted to professionals.
- Attended several conferences, workshop and Seminars in India.

Computer Skills

- Languages: C, C++, MATLAB, Python, Unix shell scripts, Visual basic, Java, Oracle, SQL Server, SharePoint Server
- Applications: LaTeX, QT Designer
- Operating Systems: Unix/Linux, Windows
- Platform: Microsoft Visual C++

Personal Details

- Permanent Address: Village and Post - Benali,
  District - Paschim Bardhaman, West Bengal - 713337
- Marital Status: Married