

A Tribute to Some of My “Teachers” Who Mattered the Most



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About a year ago when Dr. Baldev Raj asked me to write something about myself for the Newsletter, I felt honoured and agreed to do so. But when the time to write came, I was at a loss, what to write! Finally, I decided that I would write but it would primarily be a tribute to some of those who made me what I am today. I was born in Tribeni, a little village in the district of Hooghly located about 55 km North of Calcutta. My father was a primary school teacher- a true bookish “school master”, who was very smart and a symbol of honesty. He was able to do almost anything that I could imagine – from repairing watches to plumbing jobs. My mother was a homemaker, completely dedicated to the family. Both of my parents were happy to work, more than eighteen hours a day, not only to make us happy but also our neighbours and relatives. My father taught me never to be ashamed of any work as long as I believed that it was right to do so. He used to say that the goal in the school should not be to get good grades but to learn as much as you can and that would help in the long run. In numerous occasions, my parents would say, “whatever you do in life, do it with full dedication, but first and foremost try to be a good human being”. I cannot assess where I stand with respect to their expectation, but these were the guiding principles injected by my primary mentors.

One of the important lessons given by my father was about way to “success”. He said that there were three important attributes (I shall use the Bengali words and within parentheses the English translation) of a person: Saadh (volition, love for what you do/learn), Saadhya (ability) and Saadhana (devotion, pursuit). If someone has all the three attributes, then (s) he is a genius. But any two of these are enough to be successful in the usual sense of the word “successful”. He inspired by saying that I might not have the ability, but I could grow love for the subject/job, and I could train myself to be dedicated. I always considered myself a mediocre person, and still believe so and hence continue to bank on growing love for what I do and try to be dedicated to the extent that I can. Whatever I am today is a consequence of this training and a set of events connected by AND gates - had any of these gates failed, I would have lost. I mention below a few of these events.

I studied up to Higher Secondary in village schools. My father was not solvent enough to support private tutors except for a short while in class eleven. But I was extremely lucky to get wonderful teachers at my schools. For example, our Headmaster, Mr. Satya Bhanu Sur, Sir, who would be waiting for me in his office after office hours to help me with English. He wanted me to go for a research career and that is why he was very upset and expressed his unhappiness when he came to know that I joined industry after completion of M. Tech. This incidence was about nine years after I left school! What more can one expect in terms of love and motivation from a teacher? At that time, although I was working for my Ph.D thesis as a part-timer, things were not progressing the way I

expected. However, after meeting Sur Sir, I was determined to finish work for my Ph.D, and started dreaming of an academic career.

While in school, I had a dream of becoming a scientist, but my immature mind visualized a scientist as a person with dirty clothes, dirty long beard, who does not sleep, eat; does not have time for a bath and is always in the lab doing something dangerous to know the unknown! So I thought of studying physics and got selected for admission to a few well known colleges including St. Xavier's College, Calcutta. The very first impression of St. Xavier's College was so strong compared to the other colleges, I decided to join there. However, at some point of time during this process, because of comparatively higher tuition fees and other expenses, I thought of getting admitted to some other college. But, there was someone to rescue me. Mr. Satya Narayan Banerjee, a professor from a local college, when learnt this, came forward to help me through Rotary Club. Finally, this was not needed because I got a tuition waiver after a few "class tests"; not only that, but also I got all the required books from a few professors of the college. They were kind enough to allow me to keep the books for the entire duration of the course. This is also an event in that serial circuit.

While in the college, at the beginning, I was too stupid to think that poverty is a "shame" (well, today I believe, it is indeed a shame, but not for the poor but for those who run the show!) and I used to sit on the last row of the gallery to eat my tiffin (some chapatti and vegetables that my mother would prepare for me) so that others, who were eating "fancy" tiffin, could not see it. But with time my college gave me courage and confidence. Although I was a shy-boy in the class, in three years I wrote three articles, "Views from a train", "A modified Poynting's method for computation of G," the gravitational constant, and "A correction to Poiseuille's method for finding viscosity of water". These were published in college scientific magazines in different years. The magnitude of the correction to Poiseuille's method that I had found was much larger than the other corrections that were taught to physics students. Unfortunately, the text books still do not include this correction. Those were my first "research", if you allow me to say so and they gave me a lot of satisfaction and confidence. I got my first taste of research!

After this I went for a Master of Business Management (MBM) course with specialization in Operations Research. During the three years of MBM, I was teaching a few students at home to provide some financial support to my family as well as to cover my own expenses. After MBM, I was about to join a job because it was a need for the family. But my parents and others in the family were happy to go through hardships and wanted me to continue study, if I wanted to. Very reluctantly I sat for the entrance test for M.Tech. (Computer Science) of the Indian Statistical Institute (ISI). To my surprise, I got selected but provisionally because my MBM result was not announced. The institute wanted me to submit my final results by some specified date, but that was almost impossible. Somehow, one of my MBM teachers, Prof. Anil K. Sarkar came to know of it (I still do not know, how Sarkar Sir knew it and he never told me also). One day Prof. Sarkar came to ISI from his residence near Hindusthan Park (a place quite far from ISI), talked to our course in-charge, and found a way to rescue me. Prof. Sarkar made all necessary arrangements so that the viva-examination of my MBM dissertation could be completed and a confidential result could be sent to ISI. I would not be writing this article, if Prof. Sarkar would not have had voluntarily took so much of trouble for one of his students. Another major event in that serial circuit.

Although, my family never asked, I decided to go for a job after passing M.Tech. I joined Hindustan Motors, as it was near ISI. My intention was to work for the Ph.D degree as a part-timer. I could not enjoy my work at Hindustan Motors. So after about eight months, from the car manufacturer, I moved to work with a tyre manufacturer, Dunlop India Ltd, which was near my hometown. Simultaneously, I was doing some research work under the supervision of Prof. Sankar K. Pal. Although, I had published some papers during that time, I was not happy with my research progress. After working for a period of two and a half years in Dunlop India, I joined ISI in 1987 as

a Programmer and became a full professor there in 1995, and I am still there. My journey to complete the Ph.D thesis was rather smooth, but I took more time than one would be happy with. My supervisor gave me enough freedom to work on whatever I wanted and never imposed any constraint – possibly he understood my basic characteristics. My Ph.D thesis is primarily on image processing. I love modelling and quantification of uncertainty irrespective of its form, and in my thesis there are two chapters on new measures for probabilistic uncertainty and fuzzy uncertainty, and of course they are connected / applied to image processing. I obtained my Ph.D degree in 1991 from ISI. My love for dealing with uncertainty (although, I hate gambling in any form) is still there and I have been continuing to work in that area. Immediately after submitting my thesis, I attended a workshop on Neural Networks at the Indian Institute of Science, Bangalore. This made me interested in neural networks.

After completion of Ph.D, I got an offer for a regular academic job from a university in Australia and a post-doctoral fellowship from US to work with Prof. James C Bezdek (subsequently I refer to him as Jim) who, at that time was (and still is) one of the most renowned fuzzy researchers. Of course, my ISI job was there. I was in a dilemma. Part of the postdoctoral fellowship was for working on Self-Organizing Maps and this was the major driving factor for me to opt for the US. Some senior professors, including my advisor, also suggested that I join Prof. Bezdek. It was another major step in my life. This is the time when I took fuzzy sets and pattern recognition seriously. The post-doctoral period was probably the most enjoyable and academically most productive period in my career. Since 1991, I have visited Jim many times. I have done research collaborations with many national and international researchers but I have co-authored the maximum number of papers with Jim. Prof. Bezdek is known to be an excellent researcher but many think that he is a rough and tough person. In reality he has a very soft heart and is an extremely nice person who prefers to call a spade a spade irrespective of the person in front of him. He was a great mentor, both academically and otherwise. He tried to make me adapt so that I could be more acceptable by the so called “civilized” society, but probably he failed there! I have worked with him on different interesting problems. One of the problems that I enjoyed very much was quantification of total uncertainty in evidential framework. We have written many papers on clustering and cluster validation. Fuzzy clustering was introduced to eliminate some problems of crisp clustering, but in the case of fuzzy c-means (popularly known as FCM) points equidistant from the cluster centres get equal memberships irrespective of the magnitudes of their distances. To eliminate this problem, possibilistic clustering was introduced, but that suffers from the “coincident-clusters” problem. In one occasion, I visited Jim along with my wife, Dr. Kuhu Pal, who was a postdoctoral fellow. Incidentally, during the same time Prof. Jim Keller, one of the originators of the possibilistic clustering, also visited Jim. During that enjoyable trip we all four worked together and found a solution to both problems in a single framework leading to what is known as possibilistic - fuzzy c means clustering algorithms.

Things will remain incomplete, unless I share at least one story here. During one of the visits, I became quite sick because of problems with my cervical disks. Jim took me to a neurologist who among other things suggested me to sleep on a firm bed. While coming back, Jim asked me about my bed. I told him that it was very soft and I would be doing something, I was not sure what though. The following weekend, in the morning, I heard my door bell ringing. When I opened the door, I was surprised. Jim brought heavy plywood of size about seven feet by four feet in his pickup truck and some tools for carpentry work. He carried the plywood all by himself, as I could not help due to my illness, and cut it into the right size to fit my bed. I suppose, only a few lucky persons like me can get such a caring friend and a great mentor. It is interesting to note here that Jim is a great wood-worker.

My health has never been very cooperative with me. However, like in academics, here also there is someone to look after me. He is Prof. Subrata Banerjee, a renowned neurologist, who has been

treating me for almost all illnesses that I have suffered from for about 30 years. More importantly, in my crisis he is always there with suggestions, courage and strength. He has been like my elder brother, a mentor, and a guide.

Since 1991, I have been primarily working on two facets of computational intelligence – neural networks and fuzzy logic, and I occasionally do some work in evolutionary computing. In 2002 I became interested in various problems in the area of bioinformatics and still continuing work in this area. I am happy with what I am today. My work has given me some international recognition. I became a Fellow of the IEEE, USA and a Fellow of the International Fuzzy Systems Association (IFSA). I have served as the Editor-in-Chief of the *IEEE Transactions on Fuzzy Systems*, possibly the most prestigious journal in Fuzzy Systems, for a period of six years (2005-2010) – the maximum period that one can serve. At present I am serving as the Vice-President for Publications of the IEEE Computational Intelligence Society. I have been selected for the *2015 Fuzzy Systems Pioneer Award by the IEEE Computational Intelligence Society*.

Looking ahead, I want to continue my work in computational intelligence/machine learning. One of my favourite topics in pattern recognition is dimensionality reduction where in my group we have made a substantial amount of contribution. I would like to continue working in this area. Recently I have started spending quite a bit of time in the area of brain computer interface and I hope to continue the same because this area is quite challenging and it can offer many things to the society. In addition to the few great people that I have mentioned above, I gratefully acknowledge many others including my students and numerous national and international collaborators who have helped me in different ways in different contexts. Of course, things will remain incomplete if I do not acknowledge my family who continues to sacrifice the most.

The world is still so beautiful because “they” are there.