

Assignment #5

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Course: *Soft Computing* – Professor: *Prof. G C Nandi*
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Question 1

Write critical points on research paper "Bidirectional Associative Memory for Short-term Memory Learning".

Answer. A bidirectional associative memory [Kosko, 1988] stores a set of pattern associations by summing bipolar correlation matrices (an n by m outer product matrix for each pattern to be stored). Some of the BAM models can take hundreds and sometimes thousands of learning cycles to correctly associate patterns. Models should show the ability to learn quickly with excellent performance, while possessing limited memory capacity when encoding time is short. Some of the improvement done to implement such features are as follows:

- A Bidirectional Heteroassociative Memory (BHM) is introduced which uses a unique matrix to learn correlated patterns for bipolar patterns as well as for real-valued patterns.
- The transmission function used in this model is based on the classic Verhulst equation extended to a cubic form with a saturating limit at $+1$ or -1 due to that it has no asymptotic behavior as in case of sigmoid function.
- A new recency parameter was introduced called β whose value lies between $0 \leq \beta \leq 1$ which lowers the time to learn associations. Recency parameter do this by lowering the memory capacity.
- For this experiment the value of β was set at 0.99 and 0.995. This is called as Rapid learning setting, and in such setting the model is not exposed to all data-set in one epoch but only some data (like 5 associations) is fed into the model.
- BHM network can able to recall the association perfectly when fed in groups of 2, 4 and 5. However, the Hopfield and Kosco model show some errors which recalling associations. It also refresh the memory storage after each recall in order to avoid memory overload.
- As the number of epochs increased, the performance of the model increases. It means that, the batch of training sets for a greater number of cycles before updating the weight matrices leads the short-term BHM to better recall performance.

- BHM network when using a value of $\beta = 0.995$ led to perfect performance on recalls with little or no noise.
- From the paper, It showed that BAM models are well suited to perform associations using a faster learning phase.
- Introduction of recency(β) parameter could allow for more freedom on the number of items that can be kept in memory, which could vary in relation to contextual settings.