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1. **Associative Memory** unlike addressable memory, an associative memory consists of contents that shape the structure of that memory. Thus, the access patterns are based on the content rather than the addresses. As a result, the data retrieval performance is much higher in the associative memory compared with the regular memory. In humans, an associative memory is conducted to store information and remember particular information as well as relationships between unrelated items. An example of this kind of storage system could be the retrieval of faces based on their names or vice versa.

2. **Applications of Associative Memory** covers a broad array of topics. In general, all of such tasks are inherently sequential, or the method is processing the data in a sequential manner. Such sequential data often need to be remembered and retrieved in the future. Associative memory is a family of neural memory that mimics the basic structure of human mind in remembering basic patterns. It then targets various problems in **Natural Language Processing** such as **Summarization, Question Answering, Captioning, etc.** Also, most of the video processing techniques such as **Video Object Detection, Trajectory Prediction,** and almost all of the **Visual Reasoning** tasks that require processing sequences of frames inside videos require a method based on the associative memory.

3. The main difference between the **Hetroassociative** and the **Autoassociative** memory is the space in which the memory maintains data. **Hetroassociative** memory learns to store data in a format which differs from the input format of the data. For instance, take the episodic memories of your past. What has happened is a sequence of actions, scenes, hearings and sayings that has happened in the past. However, what you remember is interpretable for you from the emotional point of view. Such memory is called Hetroassociative. To illustrate the Autoassociative memory, let’s say you want to remember how to play a piano note. You learn the piano note by entering the piano sound to your

memory, and the next thing you do is to recall the exact form of melody later. Hence you are able to play that note on any instrument; whether that is a piano or a violin.

4. The **newhop** command aims to build a Hopfield network. This model is capable of learning patterns of data by passing the desired inputs and eventually, predicting a proper class of remembered patterns for a new data sample. Input to this function should be a dataset of samples. A quick example of such usage is given below:

```
data = load('data.mat');
data_p = zeros(400, 10);

for i = 1:10
    data_p(:, i) = reshape(double(numbers{i}), [400, 1]);
end

query = rands(400, 1);
hopfield_network = newhop(data_p);
[Y, Pf, Af] = hopfield_network(cell(10, 50), {}, query);
imagesc(reshape(Y{end}, [20, 20]));
```

5. The **Synchronous** mode can be problematic, because it may never converge to a specific and stable state for its variables. This simply means that the energy levels will oscillate between specific states. However, the **Asynchronous** updating rule guarantees to reach a state with a finite number of iterations. Furthermore, based on the actual Hopfield paper, A neural net operated asynchronously cannot oscillate vertically. Synchronous operation, on the other hand, can change a net's energy either positively or negatively and vertical oscillation can occur. Horizontal oscillation occurs when the net alternates between two or more states of the same energy. Certain horizontal oscillations can be avoided by adopting appropriate thresholding rules.