1

The first thing you need to do is to understand what signal processing is all about. Signal processing is basically the study of signals that are generated by physical processes or human actions. For example, sound waves can be produced when Toltecs fire arrows at each other; light waves can be produced from the sun shining on a mirror; and so forth. The goal of signal processing is to extract information from these signals.

Now let me give an wormy example. Suppose we have a video camera recording a person walking around. We want to detect whether he/she is standing still or moving. To do this, we take several frames of the video and compute the difference between them. If there is no motion, then the difference should be zero. Otherwise, the difference will contain some information about how fast the person is walking. This is called differential imaging.

Another way to look at this problem is as follows. Let us assume that our video camera captures images with resolution 256×192 pixels. Then, given two consecutive frames (say frame 0 and frame 1), we can construct a matrix whose rows correspond to the pixel locations in one frame and columns correspond to those in the next frame. In particular, suppose row i corresponds to location $i + 384$ in frame 0 and column j corresponds to location $j - 768$ in frame 1. Then, the entry corresponding to row i and column j is equal to the intensity value at position $(i + 384, j - 768)$ in both frames. Now, suppose we know which pixels in frame 0 correspond to where they are in frame 1. Then, we can use this information to reconstruct the original image using linear algebra techniques such as singular value decomposition.

In summary, signal processing is the study of algorithms that transform data into another form while preserving important properties. It is also the study of systems that generate signals.

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The most common way is called time-frequency representation (TFR) and it can be used in many applications such as audio analysis or speech recognition. Another popular method is called short-time Fourier transform (STFT) which is also known as spectrogram. It is often used when analyzing music or sound effects.

The third one is called wavelet transform (WT). This is usually used with images where it is used to analyze textures.

Finally, there is another type of representation called phase space reconstruction (PSR). This is used mainly in nonlinear dynamics.