Variable-Length Codes and Finite Automata

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Variable length codes appear frequently in the domain of data compression, historically, they appeared at the beginning of modern information theory with the seminal work of Shannon.
One of the first algorithmic results is the construction, by Huffman, of an optimal variable length code for a given frequency distribution.

Automata can be used to implement encoders and decoders, such as for compression codes, modulation codes and convolution error-correcting codes, and variable length codes are strongly related to automata, and the aim of this representation is to highlight some of the connections between these domains.

In this presentation, I will start with a few definitions and notions, and then address the problem of constructing optimal codes under various types of constraints, and then I will talk about another family of codes investigated in details are codes for coding integers, such as Elias and Golomb codes, and then I will talk about automata and transducers which are introduced insofar as coding and decoding operations are concerned.
These are applied to two special domains, namely coding with constraints on channels, and constraints on sources.
The final section is concerned with synchronization, and this has practical importance in the context of error recovery, and there are very recent theoretical results which are presented.