# 信导作业topic10

Last class,Mr Hei gave us a very interesting guide to our major.

I have learned **Channel Coding.**

In [telecommunication](https://en.wikipedia.org/wiki/Telecommunication), [information theory](https://en.wikipedia.org/wiki/Information_theory), and [coding theory](https://en.wikipedia.org/wiki/Coding_theory), **forward error correction** (**FEC**) or **channel coding**[[1]](https://en.wikipedia.org/wiki/Forward_error_correction#cite_note-1)[[2]](https://en.wikipedia.org/wiki/Forward_error_correction#cite_note-:0-2) is a technique used for [controlling errors](https://en.wikipedia.org/wiki/Error_control) in [data transmission](https://en.wikipedia.org/wiki/Data_transmission) over unreliable or noisy [communication channels](https://en.wikipedia.org/wiki/Communication_channel). The central idea is the sender encodes the message in a [redundant](https://en.wikipedia.org/wiki/Redundancy_(information_theory)) way by using an [**error-correcting code**](https://en.wikipedia.org/wiki/Error-correcting_code) (ECC).

The redundancy allows the receiver to detect a limited number of errors that may occur anywhere in the message, and often to correct these errors without re-transmission. FEC gives the receiver the ability to correct errors without needing a [reverse channel](https://en.wikipedia.org/wiki/Reverse_channel) to request re-transmission of data, but at the cost of a fixed, higher forward channel bandwidth. FEC is therefore applied in situations where re-transmissions are costly or impossible, such as one-way communication links and when transmitting to multiple receivers in [multicast](https://en.wikipedia.org/wiki/Multicast). For example, in the case of a satellite orbiting around [Uranus](https://en.wikipedia.org/wiki/Uranus), a re-transmission because of decoding errors can create a delay of 5 hours. FEC information is usually added to [mass storage](https://en.wikipedia.org/wiki/Mass_storage) (magnetic, optical and solid state/flash based) devices to enable recovery of corrupted data, is widely used in [modems](https://en.wikipedia.org/wiki/Modem), is used on systems where the primary memory is [ECC memory](https://en.wikipedia.org/wiki/ECC_memory) and in broadcast situations, where the receiver do not have capabilities to request retransmission or doing so would induce significant latency.

FEC processing in a receiver may be applied to a digital bit stream or in the demodulation of a digitally modulated carrier. For the latter, FEC is an integral part of the initial [analog-to-digital conversion](https://en.wikipedia.org/wiki/Analog-to-digital_converter) in the receiver. The [Viterbi decoder](https://en.wikipedia.org/wiki/Viterbi_decoder) implements a [soft-decision algorithm](https://en.wikipedia.org/wiki/Soft-decision_decoder) to demodulate digital data from an analog signal corrupted by noise. Many FEC coders can also generate a [bit-error rate](https://en.wikipedia.org/wiki/Bit-error_rate) (BER) signal which can be used as feedback to fine-tune the analog receiving electronics.

The maximum fractions of errors or of missing bits that can be corrected is determined by the design of the ECC, so different forward error correcting codes are suitable for different conditions. In general, a stronger code induces more redundancy that needs to be transmitted using the available bandwidth, which reduces the effective bit-rate while improving the received effective signal-to-noise ratio. The [noisy-channel coding theorem](https://en.wikipedia.org/wiki/Noisy-channel_coding_theorem) of Claude Shannon answers the question of how much bandwidth is left for data communication while using the most efficient code that turns the decoding error probability to zero. This establishes bounds on the theoretical maximum information transfer rate of a channel with some given base noise level. His proof is not constructive, and hence gives no insight of how to build a capacity achieving code. However, after years of research, some advanced FEC systems like [polar code](https://en.wikipedia.org/wiki/Polar_code_(coding_theory))[[2]](https://en.wikipedia.org/wiki/Forward_error_correction#cite_note-:0-2) come very close to the theoretical maximum.

In [coding theory](https://en.wikipedia.org/wiki/Coding_theory), the **repetition code** is one of the most basic [error-correcting codes](https://en.wikipedia.org/wiki/Error-correcting_code). In order to transmit a message over a noisy channel that may corrupt the transmission in a few places, the idea of the repetition code is to just repeat the message several times. The hope is that the channel corrupts only a minority of these repetitions. This way the receiver will notice that a transmission error occurred since the received data stream is not the repetition of a single message, and moreover, the receiver can recover the original message by looking at the received message in the data stream that occurs most often.

Because of the bad error correcting performance and the low ratio between information symbols and actually transmitted symbols, other [error correction codes](https://en.wikipedia.org/wiki/Error_correcting_codes) are preferred in most cases. The chief attraction of the repetition code is the ease of implementation.

I think it is very important to our life.

I want to learn more about this.

About [**Repetition code**](http://en.wikipedia.org/wiki/Repetition_code),I already learned a little,but also have some questions.I will continue to learn about [**Repetition code**](http://en.wikipedia.org/wiki/Repetition_code).I am very interested about it.

Wish Mr Hei to teach us more about our major.

By the learning,I have a confident heart to my major and future.Mr Hei,thank you very much.

Lastly,I want to say to Mr.Hei,”The 10th class is so difficult,my dearest teacher Hei…..呜呜呜~”

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