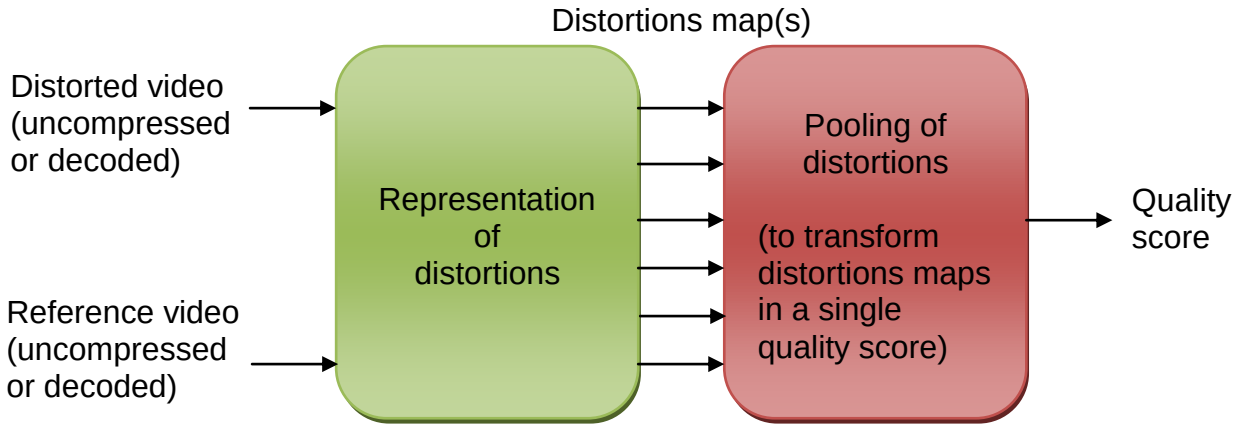
The different types of video quality metrics

Content

1. Full Reference metrics

Full Reference (FR) metrics use all the data from the reference and distorted videos to produce an objective quality score of the distorted video.

The typical functioning of a FR metric is described in figure below.



In such a FR metric:

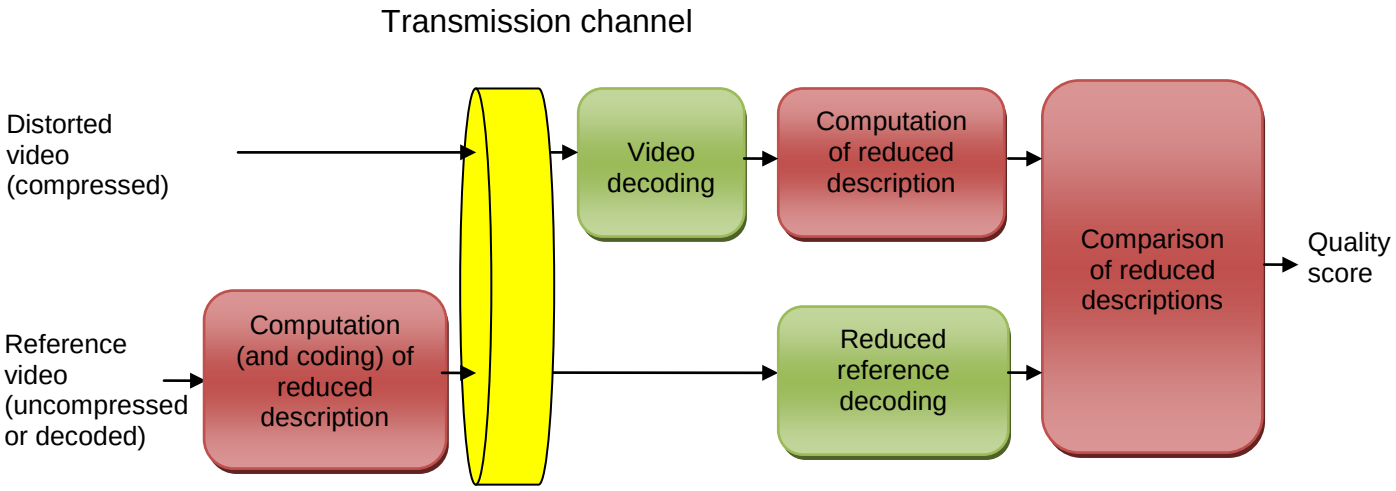
- The representation of distortions can include an elaborate model of human vision (perceptual metric) or not (MSE, SSIM, PSNR, etc.).
- The output of the distortions representation can be one or several distortions maps
- The pooling of distortions can be simple (mean value of distortions) or complex (including temporal effects of human judgment, based on density of distortions, structure of distortions).

2. Reduced Reference metrics

Reduced Reference (RR) metrics use short descriptions of the reference and distorted videos to produce an objective quality score of the distorted video. The reduced description (RD) of the reference video is called "reduced reference" (RR). Each RD is a set of data (the "features") computed from the video.

In a practical context of image quality assessment, within an image transmission service, the RR must be coded and transmitted with the compressed video data produced by the encoder. Contrary to the transmission of the compressed video, the transmission of the RR is done assuming that there is a side channel with no transmission error to transmit the RR while the sequence is transmitted through a higher bandwidth channel.

The assumption of a side channel without error is realistic as long as the RR represents a limited bandwidth and so can be quite easily protected against transmission errors. Once coded, the RR must correspond to a reasonable bit budget in order not to increase too much the amount of data to transmit. At the receiver end, one extracts the RR and compares it to the RD computed on the decoded video. From this comparison one produces an objective quality score of the distorted image. The typical deployment of a RR metric is described in figure below.

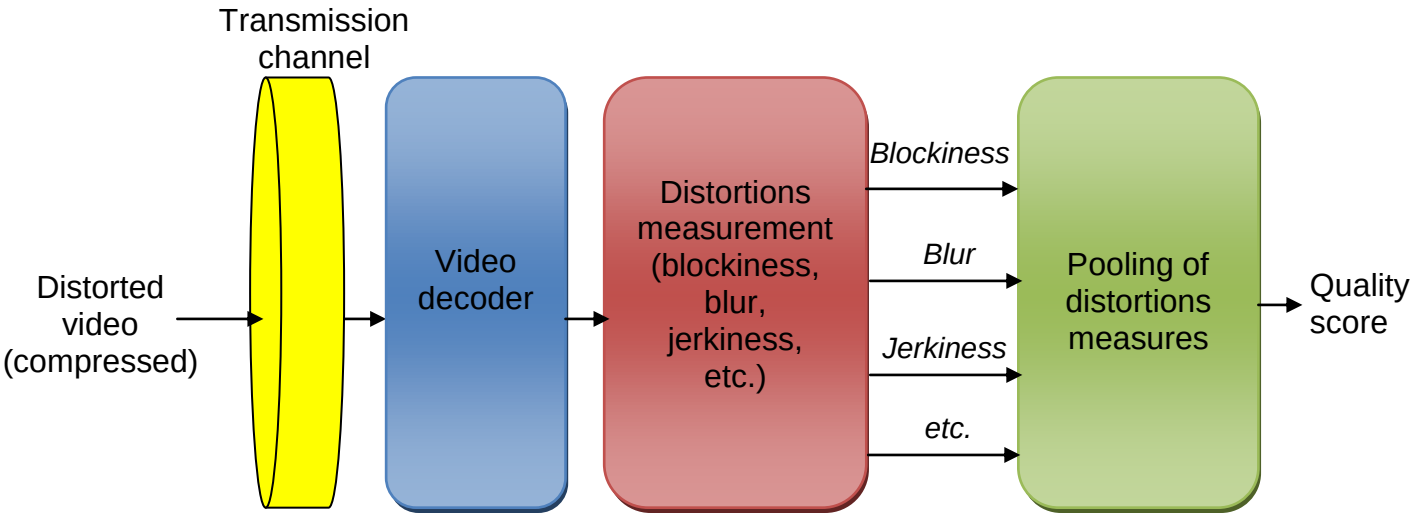


3. No Reference metrics

No Reference (FR) metrics use only the data from the distorted video to produce an objective quality score for this video. These metrics don't have any data about the reference video. However these metrics use *a priori* information about the distortions. For example, they know the type of encoding scheme that was used so that they can look for codec-specific distortions : blockiness, blur, etc...

So No Reference metrics explore the video frames at pixel level in order to detect and measure expected distortions. These distortions measures are then pooled to compute the video quality score.

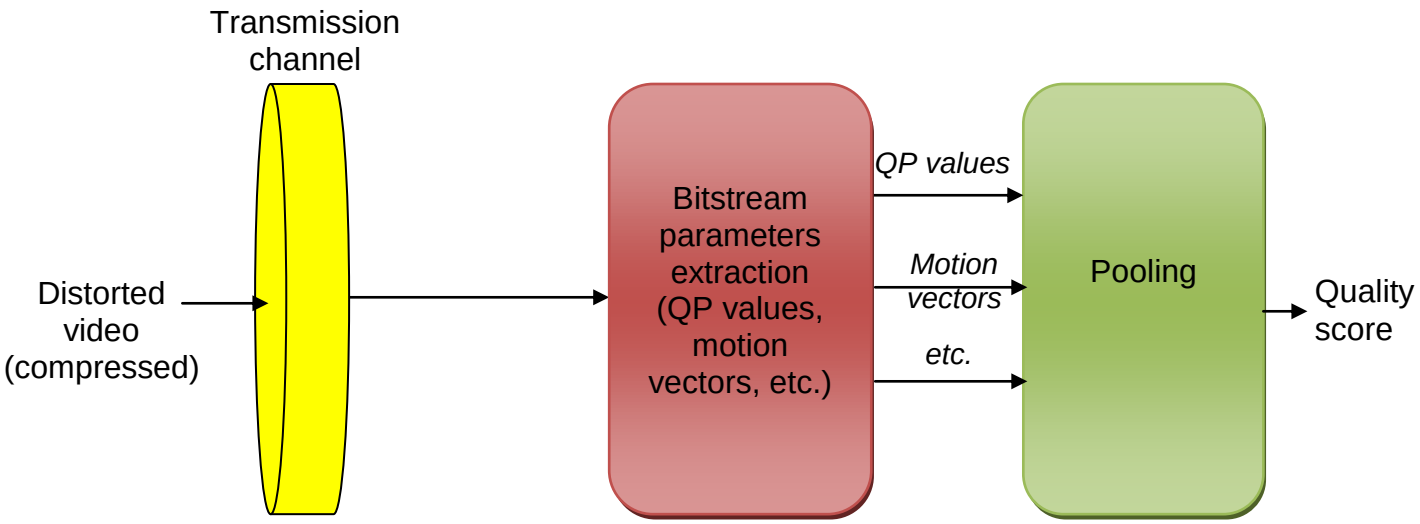
The typical functioning of a NR metric is described in figure below.



4. Parametric metrics

Parametric metrics are similar to No Reference metrics except that they use parameters extracted from the bitstream (bitrate, QP, motion vectors, badly reconstructed blocks, etc…) instead of exploring the image at pixel level. The main advantage is that parameters extraction can be performed much faster than image exploration at pixel level.

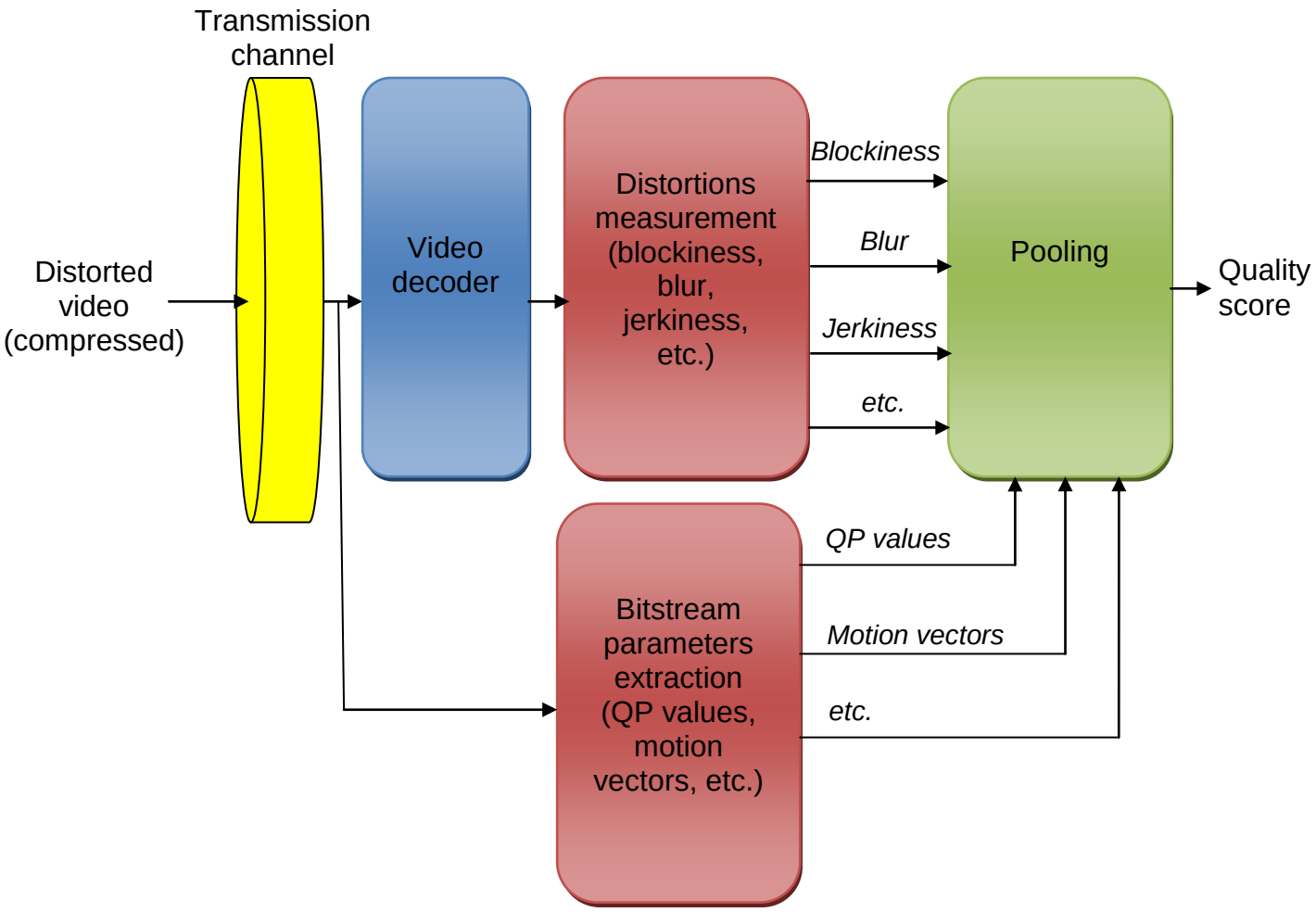
The typical functioning of an Hybrid metric is described in figure below.



5. Hybrid metrics

Hybrid metrics are a mix between No Reference metrics and Parametric metrics. They use both distortions measurement (blockiness, blur, jerkiness, etc.) from exploration of video frames at pixel level and parameters extracted from the bitstream (bitrate, QP, motion vectors, badly reconstructed blocks, etc…).

The typical functioning of an Hybrid metric is described in figure below.



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