

## Video bitrate and descriptive adjectives calculation

### Calculations of video and audio playback speed based on the information from the header of AVI

$$FramesPerSec = \frac{dwRate}{dwScale}$$

- FramesPerSec - video frame rate [frame/second]
- dwRate - rate from the AVIStreamHeader of video stream [frame/second]
- dwScale - scale from the AVIStreamHeader of video stream [---]

$$BlocksPerSec = \frac{dwRate}{dwScale}$$

- BlocksPerSec - audio data rate [block/second]
- dwRate - rate from the AVIStreamHeader of audio stream [block/second]
- dwScale - scale from the AVIStreamHeader of audio stream [---]

### Calculations of video and audio bitrates based on the information from the header of AVI

$$SizeOfAudio = \sum_{n=1}^{CountOfAudioStreams} \frac{nAvgBytesPerSec_n \cdot dwLength_n}{BlocksPerSec_n}$$

- SizeOfAudio - total size of audio information (byte)
- CountOfAudioStreams - number of audio streams (---)
- nAvgBytesPerSec - average video bitrate (byte/second)
- dwLength - length of audio (block)
- BlocksPerSec - audio block rate (block/second)

$$SizeOfHeaders = dwTotalFrames \cdot BytesPerFrameHeader \cdot (CountOfAudioStreams + 1)$$

- SizeOfHeaders - size of auxiliary information in "movi" chunk (assume audio video interleaving is - VAVAVAA or VA1A2VA1A2 in case of several audio stream)
- dwTotalFrames - total amount of video frames (assume audio and video has the same length)
- BytesPerFrameHeader - number of bytes for frame header in "movi" chunk (8 byte/frame)
- CountOfAudioStreams - quantity of audio streams (---)

$$SizeOfVideo = MoviChunkSize - SizeOfAudio - SizeOfHeaders$$

- SizeOfVideo - total size of video stream (byte)
- MoviChunkSize - size of "movi" chunk (byte)
- SizeOfAudio - total size of all audio streams (byte)

$$AudioKilobitsPerSec = \frac{8 \cdot nAvgBytesPerSec}{1000}$$

- AudioKilobitsPerSec - average audio bitrate (kilobit/second)
- nAvgBytesPerSec - average audio bitrate (byte/second)

$$VideoKilobitsPerSec = \frac{SizeOfVideo \cdot FramesPerSec \cdot 8}{dwTotalFrames \cdot 1000}$$

- VideoKilobitsPerSec - average video bitrate (kilobit/second)
- SizeOfVideo - total size of video stream (byte)
- FramesPerSec - video frame rate (frame/second)
- dwTotalFrames - total number of frames (frame)

### The accurate calculations of video and audio bitrates based on parsing of "idx1" section of AVI

$$SizeOfVideo = \sum_{n=1}^{CountOfIndexEntries(ckid="00dc")} dwChunkLength_n$$

- SizeOfVideo - total size of video (byte)
- CountOfIndexEntries - total number of elements in idx1 chunk (---)
- ckid - data type of element in "movi" chunk (00dc - first stream, compressed video) (---)
- dwChunkLength - length of element in "movi" chunk (byte)

$$SizeOfAudio = \sum_{n=1}^{CountOfIndexEntries(ckid="0xwb")} dwChunkLength_n$$

- SizeOfAudio - total size of audio (byte)

- CountOfIndexEntries - total number of elements in idx1 chunk (---)
- ckid - data type of element in "movi" chunk (0xwb - all audio streams) (---)
- dwChunkLength - length of element in "movi" chunk (byte)

$$VideoKilobitsPerSec = \frac{SizeOfVideo \cdot FramesPerSec \cdot 8}{dwTotalFrames \cdot 1000}$$

- VideoKilobitsPerSec - average video bitrate (kilobit/second)
- SizeOfVideo - total size of video (byte)
- FramesPerSec - video framerate (frame/second)
- dwTotalFrames - total number of frames (frame)

$$AudioKilobitsPerSec = \frac{SizeOfAudio \cdot BlocksPerSec \cdot 8}{dwTotalBlocks \cdot 1000}$$

- AudioKilobitsPerSec - average audio bitrate (kilobit/second)
- SizeOfAudio - total size of audio (byte)
- BlocksPerSec - audio block rate (block/second)
- dwTotalBlocks - total number of blocks (block)

## The calculation of descriptive adjectives of video stream

$$EffBitsPerPixel = \frac{VideoKilobitsPerSec \cdot 1000}{dwWidth \cdot dwHeight \cdot FramesPerSec}$$

- EffBitsPerPixel - number of bits of compressed data per pixel (bit/pixel)
- VideoKilobitsPerSec - average video bitrate (kilobit/second)
- dwWidth - width of video frame (pixel)
- dwHeight - height of video frame (pixel)
- FramesPerSec - video frame rate (frame/second)

$$VideoCompression = \left( 1 - \frac{EffBitsPerPixel}{BitsPerPixel} \right) \cdot 100\%$$

- VideoCompression - compression of video (%)
- EffBitsPerPixel - number of bits of compressed data per pixel (bit/pixel)
- BitsPerPixel - number of bits of uncompressed data per pixel (real color depth) (bit/pixel)

$$PowerOfVideoCompression = \frac{BitsPerPixel}{EffBitsPerPixel}$$

- PowerOfVideoCompression - power of video compression (---)
- BitsPerPixel - number of bits of uncompressed data per pixel (real color depth) (bit/pixel)
- EffBitsPerPixel - number of bits of compressed data per pixel (bit/pixel)

$$QualityOfVideo = \frac{3}{4} \cdot \frac{dwWidth}{dwHeight} \cdot \frac{VideoKilobitsPerSec \cdot 1000}{FramesPerSec}$$

- QualityOfVideo - effective quality of video (bit/frame 3õ4) - assume video frame is scaled to 3x4 display without disproportions (black strips may appear).
- dwWidth - width of video frame (pixel)
- dwHeight - height of video frame (pixel)
- VideoKilobitsPerSec - average video bitrate (kilobit/second)
- FramesPerSec - video frame rate (frame/second)

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