Video Compression - Hw1

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1. How to display digital video designed for TV industry (e.g. NTSC/PAL) on a computer screen with best quality?（· Hint: computer display is 4:3, 1280x1024, 72 Hz, progressive.）

To display digital video designed for the TV industry (e.g., NTSC/PAL) on a computer screen with the best quality, several key factors must be considered, including **resolution and aspect ratio adjustment, scan type conversion, refresh rate compatibility, and color space conversion.**

Detailed explanation:

1. Resolution and Aspect Ratio Adjustment

- Resampling and Scaling: NTSC typically has a resolution of 720x480, while PAL has 720x576. A standard computer display, like mentioned (1280x1024), has a higher resolution. Therefore, video content needs to be upsampled to match or be close to the monitor's resolution. This process involves resampling and scaling the image. Resampling is required to transform the image data from the original resolution to a new one, while scaling adjusts the size of the image to fit the screen properly.
- Maintaining Aspect Ratio: TV standards (NTSC/PAL) usually have a 4:3 aspect ratio, whereas some computer screens might have different aspect ratios (e.g., 5:4 for 1280x1024). To prevent image distortion, the original video's aspect ratio needs to be maintained. This might result in black bars on the sides of the video during playback.（防止圖像變形，兩側有黑邊）

2. Scan Type Conversion

- From Interlaced to Progressive Scan: TV video (especially NTSC/PAL) typically uses interlaced scanning, while computer screens use progressive scanning. For optimal quality display on computer

screens, the video needs to be converted from interlaced to progressive scan. This process, known as deinterlacing, can be achieved through various algorithms like Bob, Weave, or Motion-Adaptive Deinterlacing.

3. Refresh Rate Compatibility

- Refresh Rate Adjustment: The frame rate of TV standards (approximately 29.97 Hz for NTSC and 25 Hz for PAL) differs from the refresh rate of computer monitors. Although most modern monitors and video playback software can handle frame rate differences automatically, frame rate conversion might be necessary to adapt to the 72 Hz refresh rate of the computer display, ensuring smooth playback.

4. Color Space Conversion

- Color Space Adjustment: TV video typically uses the YUV color space, while computer monitors operate in the RGB color space. The playback software or video processing software needs to convert the video from YUV to RGB color space.

5. Appropriate Playback Software

- Use of Video Playback Software: Modern video playback software, such as VLC or MPC-HC, has built-in features to handle these conversions automatically. They can adjust resolution, aspect ratio, scan type, and color space to optimally display the video on a computer screen.