Compression

Recommended workflow using NXCAM and Final Cut Pro
About compression

- Almost all video is compressed in some way
- Several kinds
  - Interframe
  - Intraframe
- Color information is sampled less than luminance information
SONY NXCAMS SHOOT AVCHD

- Interframe compression (Temporally compressed) as well as Intraframe compression
- Interframe - compressed between frames; not all frames are equal
- Intraframe - compressed within each single frame; like JPEG
- AVCHD and h.264 are good delivery codecs, not great acquisition codecs
Temporal and spatial compression

- Temporal = Time – compressed over time (from one frame to another)
- Spatial – compressed in space (within each frame)
Why doesn’t AVCHD edit well?

- only some frames are independent, meaning they contain all pixel data
- comparable to keyframes
- most frames refer to these i-frames
- difficult simply to play forward; when scrubbing and cutting, lots of processor power needed
- cutting out an i-frame is bad for business
## Digital acquisition codecs compared

<table>
<thead>
<tr>
<th>Format</th>
<th>Bit depth</th>
<th>Resolution</th>
<th>Chroma sampling</th>
<th>Bitrate</th>
<th>File size</th>
<th>Inter-frame?</th>
<th>Algorithm type</th>
</tr>
</thead>
<tbody>
<tr>
<td>DV</td>
<td>8 bits</td>
<td>720×480 (NTSC), 720×576 (PAL)</td>
<td>4:1:1 or 4:2:0</td>
<td>25 M/bs</td>
<td>217 MB/Min.</td>
<td>No</td>
<td>DCT (lossy)</td>
</tr>
<tr>
<td>DVCPro50</td>
<td>8 bits</td>
<td>720×480 (NTSC), 720×576 (PAL)</td>
<td>4:2:2</td>
<td>50 M/bs</td>
<td>423 MB/Min.</td>
<td>No</td>
<td>DCT (lossy)</td>
</tr>
<tr>
<td>AVCHD</td>
<td>8 bits</td>
<td>1920×1080, 1440×1080, 1280×720</td>
<td>4:2:0</td>
<td>24 M/bs</td>
<td>Yes</td>
<td>DCT (lossy)</td>
<td></td>
</tr>
<tr>
<td>AVC intra</td>
<td>10 bits</td>
<td>1920×1080, 1440×1080, 1280×720</td>
<td>4:2:2</td>
<td>50 or 100 M/bs</td>
<td>No</td>
<td>DCT (lossy)</td>
<td></td>
</tr>
<tr>
<td>HDV</td>
<td>8 bits</td>
<td>1280×720, 1440×1080</td>
<td>4:2:0</td>
<td>19-25 M/bs</td>
<td>142 MB/Min. (720p), 190 MB/Min. (1080i)</td>
<td>DCT (lossy)</td>
<td></td>
</tr>
<tr>
<td>XDCAM HD422</td>
<td>8 bits</td>
<td>1280×720, 1920×1080</td>
<td>4:2:2</td>
<td>50 M/bs</td>
<td>Yes</td>
<td>DCT (lossy)</td>
<td></td>
</tr>
<tr>
<td>XDCAM EX</td>
<td>8 bits</td>
<td>1280×720, 1920×1080, 1440×1080</td>
<td>4:2:0</td>
<td>25-35 M/bs</td>
<td>190 MB/Min., 262 MB/Min.</td>
<td>DCT (lossy)</td>
<td></td>
</tr>
<tr>
<td>DVCPro HD</td>
<td>8 bits</td>
<td>960×720, 1280×1080, 1440×1080</td>
<td>4:2:2</td>
<td>100 M/bs</td>
<td>423 MB/Min. (720p60), 835 MB/Min. (1080i60)</td>
<td>No</td>
<td>DCT (lossy)</td>
</tr>
<tr>
<td>HDCAM</td>
<td>8 bits</td>
<td>1440×1080</td>
<td>3:1:1</td>
<td>144 M/bs</td>
<td>DCT (lossy)</td>
<td>No</td>
<td>DCT (lossy)</td>
</tr>
<tr>
<td>HDCAM SR</td>
<td>10 bit</td>
<td>1920×1080</td>
<td>4:2:2 or 4:4:4</td>
<td>440 or 880 M/bs</td>
<td>No</td>
<td>DCT (lossy)</td>
<td></td>
</tr>
<tr>
<td>Panasonic SSR</td>
<td>10-bit ParaLog</td>
<td>1920×1080</td>
<td>4:2:2 or 4:4:4</td>
<td>up to 3 G/bs</td>
<td>No</td>
<td>Uncompressed</td>
<td></td>
</tr>
<tr>
<td>CineForm RAW (8K)</td>
<td>10-bit Log</td>
<td>2048×1152</td>
<td>Raw Bayer</td>
<td>100-140 M/bs</td>
<td>800 MB/Min.</td>
<td>No</td>
<td>Wavelet (lossy)</td>
</tr>
<tr>
<td>Dirac</td>
<td>8 bits, 10 bits, 12 bits, 16 bits</td>
<td>multi resolution</td>
<td>4:2:0, 4:2:2, 4:4:4</td>
<td>(both options in different implementations)</td>
<td>Wavelet (lossy and also lossless)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>REDCODE RAW</td>
<td>12 bits</td>
<td>4520×2540, 4480×1920, 4096×2304</td>
<td>Raw Bayer</td>
<td>224-536 M/bs</td>
<td>1.6-2.5 GB/Min.</td>
<td>No</td>
<td>Wavelet (lossy)</td>
</tr>
<tr>
<td>ARRRAW</td>
<td>12 bits</td>
<td>2880×2160</td>
<td>Raw Bayer</td>
<td>~ 5.6 G/bs</td>
<td>42 GB/Min.</td>
<td>No</td>
<td>Uncompressed</td>
</tr>
<tr>
<td>&quot;Dalsa&quot; RAW</td>
<td>16 bits</td>
<td>4096×2048</td>
<td>Raw Bayer</td>
<td>~ 3.2 G/bs</td>
<td>No</td>
<td>Uncompressed</td>
<td></td>
</tr>
<tr>
<td>Viper Filmstream</td>
<td>12-bit linear, 10-bit log</td>
<td>1920×1080, 1280×720</td>
<td>4:4:4</td>
<td>up to ~2.24 G/bs</td>
<td>No</td>
<td>Uncompressed</td>
<td></td>
</tr>
<tr>
<td>Drama RAW</td>
<td>12-bit linear</td>
<td>1920×1080</td>
<td>Raw Bayer</td>
<td>600 M/bs/sec</td>
<td>4.5 GB/Min.</td>
<td>No</td>
<td>Uncompressed</td>
</tr>
</tbody>
</table>
AVCHD

- AVCHD filesize=180 MB/minute (for 1080p, 24 MBPS)
- can’t be edited directly in Final Cut Pro 7
- Files must be “transcoded” to an editing codec
- some programs can edit natively, only on high-end computers
What is transcoding?

- Videos are transcoded to ProRes or Apple Intermediate Codec (AIC)
- ProRes has no intraframe compression; every frame is independent
- This means cutting can be done on common computers
- Also leads to larger file sizes
- Bitrate is higher than AVCHD, but much lower than Uncompressed
- Size = 1GB per minute of 1920x1080 footage (variable)
Different flavors of ProRes Projects
use Log and Transfer dialog
Choose which ProRes codec in preferences menu
Transcoding, cont.

- Set Scratch Disk first; files will be saved there (be sure to do this)
- Card readers attach via USB; transcoding may take several minutes
- Make sure to backup transcoded footage; cards can be reformatted for future shoots
Resolution examples

- ProRes is frame size independent; will work on SD, HD, even 4K resolutions
Difference between format and resolution

- Format refers to the “acquisition system”
- i.e. HD can be recorded in several formats
  - HDV - 1440x1080 res., 25MBPS bitrate, temporal and spatial compression, tape based
  - AVCHD - several resolutions, different bitrates, file based, temporal and spatial compression
  - DVCPRO HD - different resolutions, 50 or 100 MBPS
  - HDCAM - similar compression to DVCPRO but at higher bitrates
  - XDCAM - different compression schemes for different uses
Overview

- Capture AVCHD on your SDHC cards
- On ingest, transcode to a ProRes codec
- Edit in ProRes (or smaller ProRes Proxy)
- Export full size file – Master – in same format (not re-compressed)
- Compress Master for delivery
Format conversion

- consider needs for different deliverables
- do you need Master tape outputs in different formats? (HD, SD, NTSC, PAL)
- web output?
  - web compression may be different for different venues
- DVD? Blu-Ray?
Delivery compression

- MPEG-2 for DVD
- MPEG-2, h.264, VC-1 for Blu-Ray
  - Blu-Ray authoring notoriously difficult
- h.264 is popular for web; also flv
Media Manage

- use Media Manage to copy/consolidate final sequence with used media
- this saves only media you ended up using in your sequence
- Can also manually move all media used (including graphics, Motion documents, music, etc) to an Archive folder
Examples of Compression

- Sitting in a video room: http://www.youtube.com/watch?v=icruGcSsPp0
- Walking shot - ProRes - not included because of file size
- Walking shot - JPEG
- Walking shot - h.264 (2 MBPS)
- Walking shot - h.264 (500 KBPS)