數字媒體技術基礎作業

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1 目标

本作业主题为熵编码，在 ITM 进行改进与准备。

2 事前

在此制作 5 个 10 秒与 5 个 4 秒的测试影片，并转成 YUV 影像，其素材取自深圳市大学城北大校区邻近图书馆与图书馆咖啡厅一带，内容包含了图书馆咖啡厅、图书馆旁的步道、图书馆内书架陈列、图书馆旁的草皮与隐藏人物。各视频录制约 10 秒，并同时准备 4 秒的版本，最后再输出乘 YUV。

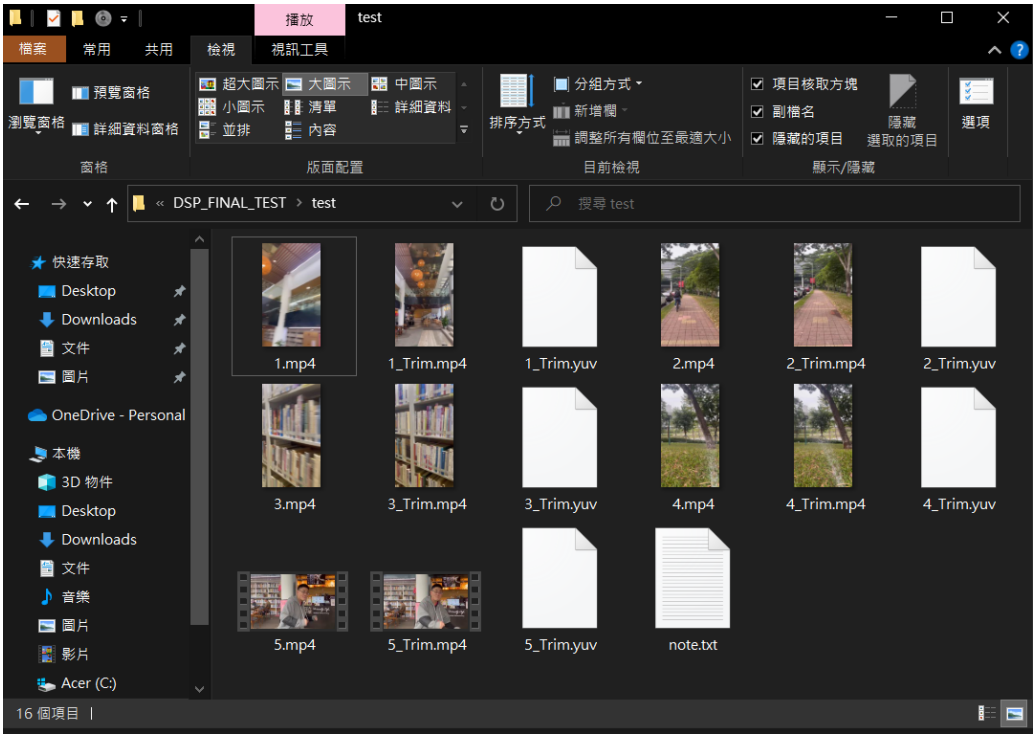

Fig. 1. 测试资料表列结果

3 指令

首先使用 FFMPEG 产生 YUV 档案，其产生过程的纪录如下。

1. 图书馆咖啡厅

```
(base) PS D:\USERDATA\Desktop\DSP_FINAL_TEST\test> ffmpeg -i 1_Trim.mp4 -s 320x240 -pix_fmt yuv420p -r 15 1_Trim.yuv
ffmpeg version 2021-09-22-git-447cf53774-full_build-www.gyan.dev Copyright (c) 2000-2021 the FFmpeg developers
  built with gcc 10.3.0 (Rev5, Built by MSYS2 project)
  configuration: --enable-gpl --enable-version3 --enable-static --disable-w32threads --disable-autodetect --enable-fontconfig --enable-iconv --enable-gnutls --enable-libxml2 --enable-gmp --enable-lzma --enable-libsnappy --enable-zlib --enable-librist --enable-libsrt --enable-libssh --enable-libzmq --enable-avisynth --enable-libbluray --enable-libcaca --enable-sdl2 --enable-libdav1d --enable-libzvbi --enable-librav1e --enable-libsvtav1 --enable-libwebp --enable-libx264 --enable-libx265 --enable-libxvid --enable-libaom --enable-libopenjpeg --enable-libvpx --enable-libass --enable-frei0r --enable-libfreetype --enable-libfribidi --enable-libvidstab --enable-libvmaf --enable-libzimg --enable-amf --enable-cuda-llvm --enable-cuvid --enable-ffnvcodec --enable-nvdec --enable-nvenc --enable-d3d11va --enable-dxva2 --enable-libmfx --enable-libglslang --enable-vulkan --enable-opencl --enable-libcdio --enable-libgme --enable-libmodplug --enable-libopenmpt --enable-libopencore-amrwb --enable-libmp3lame --enable-libshine --enable-libtheora --enable-libtwolame --enable-libvo-amrwbenc --enable-libilbc --enable-libgsm --enable-libopencore-amrnb --enable-libopus --enable-libspeex --enable-libvorbis --enable-ladspa --enable-libbs2b --enable-libflite --enable-libmysofa --enable-librubberband --enable-libsoxr --enable-chromaprint
  libavutil      57.  6.100 / 57.  6.100
  libavcodec     59.  9.100 / 59.  9.100
  libavformat    59.  5.100 / 59.  5.100
  libavdevice    59.  0.101 / 59.  0.101
  libavfilter     8.  9.100 /  8.  9.100
  libswscale      6.  1.100 /  6.  1.100
  libswresample   4.  0.100 /  4.  0.100
  libpostproc    56.  0.100 / 56.  0.100
Input #0, mov,mp4,m4a,3gp,3g2,mj2, from '1_Trim.mp4':
  Metadata:
    major_brand     : mp42
    minor_version   : 0
    compatible_brands: mp41isom
    creation_time   : 2021-12-14T01:47:50.000000Z
  Duration: 00:00:04.19, start: 0.000000, bitrate: 3808 kb/s
  Stream #0:0[0x1](und): Video: h264 (Main) (avc1 / 0x31637661), yuv420p, 544x960 [SAR 1:1 DAR 17:30], 3700 kb/s, 30 fps, 30 tbr, 30k tbn (default)
    Metadata:
      creation_time   : 2021-12-18T06:23:36.000000Z
      handler_name    : VideoHandler
      vendor_id       : [0][0][0][0]
      encoder         : AVC Coding
```

```
  Stream #0:1[0x2](und): Audio: aac (LC) (mp4a / 0x6134706D), 48000 Hz, stereo, fltp, 180 kb/s (default)
    Metadata:
      creation_time   : 2021-12-18T06:23:36.000000Z
      handler_name    : SoundHandler
      vendor_id       : [0][0][0][0]
Stream mapping:
  Stream #0:0 -> #0:0 (h264 (native) -> rawvideo (native))
Press [q] to stop, [?] for help
Output #0, rawvideo, to '1_Trim.yuv':
  Metadata:
    major_brand     : mp42
    minor_version   : 0
    compatible_brands: mp41isom
    encoder         : Lavf59.5.100
  Stream #0:0(und): Video: rawvideo (I420 / 0x30323449), yuv420p(tv, progressive), 320x240 [SAR 17:40 DAR 17:30], q=2-31, 13824 kb/s, 15 fps, 15 tbn (default)
    Metadata:
      creation_time   : 2021-12-18T06:23:36.000000Z
      handler_name    : VideoHandler
      vendor_id       : [0][0][0][0]
      encoder         : Lavc59.9.100 rawvideo
frame=   63 fps=0.0 q=-0.0 Lsize=    7088kB time=00:00:04.20 bitrate=13824.0 kbits/s dup=0 drop=60 speed=8.21x
video:7088kB audio:0kB subtitle:0kB other streams:0kB global headers:0kB muxing overhead: 0.000000%
(base) PS D:\USERDATA\Desktop\DSP_FINAL_TEST\test>
```

2. 图书馆旁的步道

```
(base) PS D:\USERDATA\Desktop\DSP_FINAL_TEST\test> ffmpeg -i 2_Trim.mp4 -s 320x240 -pix_fmt yuv420p -r 15 2_Trim.yuv
ffmpeg version 2021-09-22-git-447cf53774-full_build-www.gyan.dev Copyright (c) 2000-2021 the FFmpeg developers
  built with gcc 10.3.0 (Rev5, Built by MSYS2 project)
  configuration: --enable-gpl --enable-version3 --enable-static --disable-w32threads --disable-autodetect --enable-fontconfig --enable-iconv --enable-gnutls --enable-libxml2 --enable-gmp --enable-lzma --enable-libsnappy --enable-zlib --enable-librist --enable-libsrt --enable-libssh --enable-libzmq --enable-avisynth --enable-libbluray --enable-libcaca --enable-sdl2 --enable-libdav1d --enable-libzvbi --enable-librav1e --enable-libsvtav1 --enable-libwebp --enable-libx264 --enable-libx265 --enable-libxvid --enable-libaom --enable-libopenjpeg --enable-libvpx --enable-libass --enable-frei0r --enable-libfreetype --enable-libfribidi --enable-libvidstab --enable-libvmaf --enable-libzimg --enable-amf --enable-cuda-llvm --enable-cuvid --enable-ffnvcodec --enable-nvdec --enable-nvenc --enable-d3d11va --enable-dxva2 --enable-libmfx --enable-libglslang --enable-vulkan --enable-opencl
```

```
    --enable-libcdio --enable-libgme --enable-libmodplug --enable-libopenmpt --
    enable-libopencore-amrwb --enable-libmp3lame --enable-libshine --enable-
    libtheora --enable-libtwolame --enable-libvo-amrwbenc --enable-libilbc --
    enable-libgsm --enable-libopencore-amrnb --enable-libopus --enable-libspeex
     --enable-libvorbis --enable-ladspa --enable-libbs2b --enable-libflite --
    enable-libmysofa --enable-librubberband --enable-libsoxr --enable-
    chromaprint
  libavutil      57.  6.100 / 57.  6.100
  libavcodec     59.  9.100 / 59.  9.100
  libavformat    59.  5.100 / 59.  5.100
  libavdevice    59.  0.101 / 59.  0.101
  libavfilter     8.  9.100 /  8.  9.100
  libswscale      6.  1.100 /  6.  1.100
  libswresample   4.  0.100 /  4.  0.100
  libpostproc    56.  0.100 / 56.  0.100
Input #0, mov,mp4,m4a,3gp,3g2,mj2, from '2_Trim.mp4':
  Metadata:
    major_brand     : mp42
    minor_version   : 0
    compatible_brands: mp41isom
    creation_time   : 2021-12-14T01:47:20.000000Z
  Duration: 00:00:04.98, start: 0.000000, bitrate: 11162 kb/s
  Stream #0:0[0x1](und): Video: h264 (Main) (avc1 / 0x31637661), yuv420p, 720
    x1280 [SAR 1:1 DAR 9:16], 11302 kb/s, 30 fps, 30 tbr, 30k tbn (default)
    Metadata:
      creation_time   : 2021-12-18T06:24:19.000000Z
      handler_name    : VideoHandler
      vendor_id       : [0][0][0][0]
      encoder         : AVC Coding
  Stream #0:1[0x2](und): Audio: aac (LC) (mp4a / 0x6134706D), 48000 Hz, stereo,
    fltp, 180 kb/s (default)
    Metadata:
      creation_time   : 2021-12-18T06:24:19.000000Z
      handler_name    : SoundHandler
      vendor_id       : [0][0][0][0]
Stream mapping:
  Stream #0:0 -> #0:0 (h264 (native) -> rawvideo (native))
Press [q] to stop, [?] for help
Output #0, rawvideo, to '2_Trim.yuv':
  Metadata:
    major_brand     : mp42
    minor_version   : 0
    compatible_brands: mp41isom
    encoder         : Lavf59.5.100
  Stream #0:0(und): Video: rawvideo (I420 / 0x30323449), yuv420p(tv, progressive
    ), 320x240 [SAR 27:64 DAR 9:16], q=2-31, 13824 kb/s, 15 fps, 15 tbn (
    default)
```

```
    Metadata:
      creation_time   : 2021-12-18T06:24:19.000000Z
      handler_name    : VideoHandler
      vendor_id       : [0][0][0][0]
      encoder         : Lavc59.9.100 rawvideo
frame=   75 fps=0.0 q=-0.0 Lsize=    8438kB time=00:00:05.00 bitrate=13824.0
    kbits/s dup=1 drop=71 speed= 5.6x
video:8438kB audio:0kB subtitle:0kB other streams:0kB global headers:0kB muxing
    overhead: 0.000000%
(base) PS D:\USERDATA\Desktop\DSP_FINAL_TEST\test>
```

3. 图书馆内书架陈列

```
(base) PS D:\USERDATA\Desktop\DSP_FINAL_TEST\test> ffmpeg -i 3_Trim.mp4 -s 320
    x240 -pix_fmt yuv420p -r 15 3_Trim.yuv
ffmpeg version 2021-09-22-git-447cf53774-full_build-www.gyan.dev Copyright (c)
    2000-2021 the FFmpeg developers
  built with gcc 10.3.0 (Rev5, Built by MSYS2 project)
  configuration: --enable-gpl --enable-version3 --enable-static --disable-
      w32threads --disable-autodetect --enable-fontconfig --enable-iconv --enable
      -gnutls --enable-libxml2 --enable-gmp --enable-lzma --enable-libsnappy --
      enable-zlib --enable-librist --enable-libsrt --enable-libssh --enable-
      libzmq --enable-avisynth --enable-libbluray --enable-libcaca --enable-sdl2
      --enable-libdav1d --enable-libzvbi --enable-librav1e --enable-libsvtav1 --
      enable-libwebp --enable-libx264 --enable-libx265 --enable-libxvid --enable-
      libaom --enable-libopenjpeg --enable-libvpx --enable-libass --enable-frei0r
       --enable-libfreetype --enable-libfribidi --enable-libvidstab --enable-
      libvmaf --enable-libzimg --enable-amf --enable-cuda-llvm --enable-cuvid --
      enable-ffnvcodec --enable-nvdec --enable-nvenc --enable-d3d11va --enable-
      dxva2 --enable-libmfx --enable-libglslang --enable-vulkan --enable-opencl
      --enable-libcdio --enable-libgme --enable-libmodplug --enable-libopenmpt --
      enable-libopencore-amrwb --enable-libmp3lame --enable-libshine --enable-
      libtheora --enable-libtwolame --enable-libvo-amrwbenc --enable-libilbc --
      enable-libgsm --enable-libopencore-amrnb --enable-libopus --enable-libspeex
       --enable-libvorbis --enable-ladspa --enable-libbs2b --enable-libflite --
      enable-libmysofa --enable-librubberband --enable-libsoxr --enable-
      chromaprint
  libavutil      57.  6.100 / 57.  6.100
  libavcodec     59.  9.100 / 59.  9.100
  libavformat    59.  5.100 / 59.  5.100
  libavdevice    59.  0.101 / 59.  0.101
  libavfilter     8.  9.100 /  8.  9.100
  libswscale      6.  1.100 /  6.  1.100
  libswresample   4.  0.100 /  4.  0.100
  libpostproc    56.  0.100 / 56.  0.100
Input #0, mov,mp4,m4a,3gp,3g2,mj2, from '3_Trim.mp4':
  Metadata:
    major_brand     : mp42
```

```
    minor_version   : 0
    compatible_brands: mp41isom
    creation_time   : 2021-12-14T01:47:41.000000Z
  Duration: 00:00:04.89, start: 0.000000, bitrate: 3705 kb/s
  Stream #0:0[0x1](und): Video: h264 (Main) (avc1 / 0x31637661), yuv420p, 544
      x960 [SAR 1:1 DAR 17:30], 3643 kb/s, 30 fps, 30 tbr, 30k tbn (default)
    Metadata:
      creation_time   : 2021-12-18T06:24:54.000000Z
      handler_name    : VideoHandler
      vendor_id       : [0][0][0][0]
      encoder         : AVC Coding
  Stream #0:1[0x2](und): Audio: aac (LC) (mp4a / 0x6134706D), 48000 Hz, stereo,
      fltp, 176 kb/s (default)
    Metadata:
      creation_time   : 2021-12-18T06:24:54.000000Z
      handler_name    : SoundHandler
      vendor_id       : [0][0][0][0]
Stream mapping:
  Stream #0:0 -> #0:0 (h264 (native) -> rawvideo (native))
Press [q] to stop, [?] for help
Output #0, rawvideo, to '3_Trim.yuv':
  Metadata:
    major_brand     : mp42
    minor_version   : 0
    compatible_brands: mp41isom
    encoder         : Lavf59.5.100
  Stream #0:0(und): Video: rawvideo (I420 / 0x30323449), yuv420p(tv, progressive
      ), 320x240 [SAR 17:40 DAR 17:30], q=2-31, 13824 kb/s, 15 fps, 15 tbn (
      default)
    Metadata:
      creation_time   : 2021-12-18T06:24:54.000000Z
      handler_name    : VideoHandler
      vendor_id       : [0][0][0][0]
      encoder         : Lavc59.9.100 rawvideo
frame=   74 fps=0.0 q=-0.0 Lsize=    8325kB time=00:00:04.93 bitrate=13824.0
    kbits/s dup=1 drop=69 speed=12.2x
video:8325kB audio:0kB subtitle:0kB other streams:0kB global headers:0kB muxing
    overhead: 0.000000%
(base) PS D:\USERDATA\Desktop\DSP_FINAL_TEST\test>
```

4. 图书馆旁的草皮

```
(base) PS D:\USERDATA\Desktop\DSP_FINAL_TEST\test> ffmpeg -i 4_Trim.mp4 -s 320
    x240 -pix_fmt yuv420p -r 15 4_Trim.yuv
ffmpeg version 2021-09-22-git-447cf53774-full_build-www.gyan.dev Copyright (c)
    2000-2021 the FFmpeg developers
  built with gcc 10.3.0 (Rev5, Built by MSYS2 project)
  configuration: --enable-gpl --enable-version3 --enable-static --disable-
```

```
      w32threads --disable-autodetect --enable-fontconfig --enable-iconv --enable
      -gnutls --enable-libxml2 --enable-gmp --enable-lzma --enable-libsnappy --
      enable-zlib --enable-librist --enable-libsrt --enable-libssh --enable-
      libzmq --enable-avisynth --enable-libbluray --enable-libcaca --enable-sdl2
      --enable-libdav1d --enable-libzvbi --enable-librav1e --enable-libsvtav1 --
      enable-libwebp --enable-libx264 --enable-libx265 --enable-libxvid --enable-
      libaom --enable-libopenjpeg --enable-libvpx --enable-libass --enable-frei0r
       --enable-libfreetype --enable-libfribidi --enable-libvidstab --enable-
      libvmaf --enable-libzimg --enable-amf --enable-cuda-llvm --enable-cuvid --
      enable-ffnvcodec --enable-nvdec --enable-nvenc --enable-d3d11va --enable-
      dxva2 --enable-libmfx --enable-libglslang --enable-vulkan --enable-opencl
      --enable-libcdio --enable-libgme --enable-libmodplug --enable-libopenmpt --
      enable-libopencore-amrwb --enable-libmp3lame --enable-libshine --enable-
      libtheora --enable-libtwolame --enable-libvo-amrwbenc --enable-libilbc --
      enable-libgsm --enable-libopencore-amrnb --enable-libopus --enable-libspeex
       --enable-libvorbis --enable-ladspa --enable-libbs2b --enable-libflite --
      enable-libmysofa --enable-librubberband --enable-libsoxr --enable-
      chromaprint
  libavutil      57.  6.100 / 57.  6.100
  libavcodec     59.  9.100 / 59.  9.100
  libavformat    59.  5.100 / 59.  5.100
  libavdevice    59.  0.101 / 59.  0.101
  libavfilter     8.  9.100 /  8.  9.100
  libswscale      6.  1.100 /  6.  1.100
  libswresample   4.  0.100 /  4.  0.100
  libpostproc    56.  0.100 / 56.  0.100
Input #0, mov,mp4,m4a,3gp,3g2,mj2, from '4_Trim.mp4':
  Metadata:
    major_brand     : mp42
    minor_version   : 0
    compatible_brands: mp41isom
    creation_time   : 2021-12-14T01:47:31.000000Z
  Duration: 00:00:04.87, start: 0.000000, bitrate: 14394 kb/s
  Stream #0:0[0x1](und): Video: h264 (Main) (avc1 / 0x31637661), yuv420p, 720
     x1280 [SAR 1:1 DAR 9:16], 14600 kb/s, 30 fps, 30 tbr, 30k tbn (default)
    Metadata:
      creation_time   : 2021-12-18T06:26:14.000000Z
      handler_name    : VideoHandler
      vendor_id       : [0][0][0][0]
      encoder         : AVC Coding
  Stream #0:1[0x2](und): Audio: aac (LC) (mp4a / 0x6134706D), 48000 Hz, stereo,
     fltp, 198 kb/s (default)
    Metadata:
      creation_time   : 2021-12-18T06:26:14.000000Z
      handler_name    : SoundHandler
      vendor_id       : [0][0][0][0]
Stream mapping:
```

```
  Stream #0:0 -> #0:0 (h264 (native) -> rawvideo (native))
Press [q] to stop, [?] for help
Output #0, rawvideo, to '4_Trim.yuv':
  Metadata:
    major_brand     : mp42
    minor_version   : 0
    compatible_brands: mp41isom
    encoder         : Lavf59.5.100
  Stream #0:0(und): Video: rawvideo (I420 / 0x30323449), yuv420p(tv, progressive), 320x240 [SAR 27:64 DAR 9:16], q=2-31, 13824 kb/s, 15 fps, 15 tbn (default)
    Metadata:
      creation_time   : 2021-12-18T06:26:14.000000Z
      handler_name    : VideoHandler
      vendor_id       : [0][0][0][0]
      encoder         : Lavc59.9.100 rawvideo
frame=   74 fps=0.0 q=-0.0 Lsize=    8325kB time=00:00:04.93 bitrate=13824.0 kbits/s dup=1 drop=69 speed=5.28x
video:8325kB audio:0kB subtitle:0kB other streams:0kB global headers:0kB muxing overhead: 0.000000%
(base) PS D:\USERDATA\Desktop\DSP_FINAL_TEST\test>
```

5. 隐藏人物

```
(base) PS D:\USERDATA\Desktop\DSP_FINAL_TEST\test> ffmpeg -i 5_Trim.mp4 -s 320x240 -pix_fmt yuv420p -r 15 5_Trim.yuv
ffmpeg version 2021-09-22-git-447cf53774-full_build-www.gyan.dev Copyright (c) 2000-2021 the FFmpeg developers
  built with gcc 10.3.0 (Rev5, Built by MSYS2 project)
  configuration: --enable-gpl --enable-version3 --enable-static --disable-w32threads --disable-autodetect --enable-fontconfig --enable-iconv --enable-gnutls --enable-libxml2 --enable-gmp --enable-lzma --enable-libsnappy --enable-zlib --enable-librist --enable-libsrt --enable-libssh --enable-libzmq --enable-avisynth --enable-libbluray --enable-libcaca --enable-sdl2 --enable-libdav1d --enable-libzvbi --enable-librav1e --enable-libsvtav1 --enable-libwebp --enable-libx264 --enable-libx265 --enable-libxvid --enable-libaom --enable-libopenjpeg --enable-libvpx --enable-libass --enable-frei0r --enable-libfreetype --enable-libfribidi --enable-libvidstab --enable-libvmaf --enable-libzimg --enable-amf --enable-cuda-llvm --enable-cuvid --enable-ffnvcodec --enable-nvdec --enable-nvenc --enable-d3d11va --enable-dxva2 --enable-libmfx --enable-libglslang --enable-vulkan --enable-opencl --enable-libcdio --enable-libgme --enable-libmodplug --enable-libopenmpt --enable-libopencore-amrwb --enable-libmp3lame --enable-libshine --enable-libtheora --enable-libtwolame --enable-libvo-amrwbenc --enable-libilbc --enable-libgsm --enable-libopencore-amrnb --enable-libopus --enable-libspeex --enable-libvorbis --enable-ladspa --enable-libbs2b --enable-libflite --enable-libmysofa --enable-librubberband --enable-libsoxr --enable-chromaprint
```

```
  libavutil      57.  6.100 / 57.  6.100
  libavcodec     59.  9.100 / 59.  9.100
  libavformat    59.  5.100 / 59.  5.100
  libavdevice    59.  0.101 / 59.  0.101
  libavfilter     8.  9.100 /  8.  9.100
  libswscale      6.  1.100 /  6.  1.100
  libswresample   4.  0.100 /  4.  0.100
  libpostproc    56.  0.100 / 56.  0.100
Input #0, mov,mp4,m4a,3gp,3g2,mj2, from '5_Trim.mp4':
  Metadata:
    major_brand     : mp42
    minor_version   : 0
    compatible_brands: mp41isom
    creation_time   : 2021-12-14T01:47:59.000000Z
  Duration: 00:00:04.93, start: 0.000000, bitrate: 4755 kb/s
  Stream #0:0[0x1](und): Video: h264 (Main) (avc1 / 0x31637661), yuv420p, 1280
      x720 [SAR 1:1 DAR 16:9], 4733 kb/s, 30 fps, 30 tbr, 30k tbn (default)
    Metadata:
      creation_time   : 2021-12-18T06:27:01.000000Z
      handler_name    : VideoHandler
      vendor_id       : [0][0][0][0]
      encoder         : AVC Coding
  Stream #0:1[0x2](und): Audio: aac (LC) (mp4a / 0x6134706D), 48000 Hz, stereo,
      fltp, 179 kb/s (default)
    Metadata:
      creation_time   : 2021-12-18T06:27:01.000000Z
      handler_name    : SoundHandler
      vendor_id       : [0][0][0][0]
Stream mapping:
  Stream #0:0 -> #0:0 (h264 (native) -> rawvideo (native))
Press [q] to stop, [?] for help
Output #0, rawvideo, to '5_Trim.yuv':
  Metadata:
    major_brand     : mp42
    minor_version   : 0
    compatible_brands: mp41isom
    encoder         : Lavf59.5.100
  Stream #0:0(und): Video: rawvideo (I420 / 0x30323449), yuv420p(tv, progressive
      ), 320x240 [SAR 4:3 DAR 16:9], q=2-31, 13824 kb/s, 15 fps, 15 tbn (default)
    Metadata:
      creation_time   : 2021-12-18T06:27:01.000000Z
      handler_name    : VideoHandler
      vendor_id       : [0][0][0][0]
      encoder         : Lavc59.9.100 rawvideo
frame=   74 fps=0.0 q=-0.0 Lsize=    8325kB time=00:00:04.93 bitrate=13824.0
    kbits/s dup=1 drop=70 speed=8.97x
video:8325kB audio:0kB subtitle:0kB other streams:0kB global headers:0kB muxing
```

```
    overhead: 0.000000%
48 (base) PS D:\USERDATA\Desktop\DSP_FINAL_TEST\test>
```

各指令记录如下:

```
1  ffmpeg -i 1_Trim.mp4 -s 320x240 -pix_fmt yuv420p -r 15 1_Trim.yuv
2
3  ffmpeg -i 2_Trim.mp4 -s 320x240 -pix_fmt yuv420p -r 15 2_Trim.yuv
4
5  ffmpeg -i 3_Trim.mp4 -s 320x240 -pix_fmt yuv420p -r 15 3_Trim.yuv
6
7  ffmpeg -i 4_Trim.mp4 -s 320x240 -pix_fmt yuv420p -r 15 4_Trim.yuv
8
9  ffmpeg -i 5_Trim.mp4 -s 320x240 -pix_fmt yuv420p -r 15 5_Trim.yuv
10
11 ffplay -video_size 320x240 -i 1_Trim.yuv
12
13 ffplay -video_size 320x240 -i 2_Trim.yuv
14
15 ffplay -video_size 320x240 -i 3_Trim.yuv
16
17 ffplay -video_size 320x240 -i 4_Trim.yuv
18
19 ffplay -video_size 320x240 -i 5_Trim.yuv
```

最后播放结果如下:

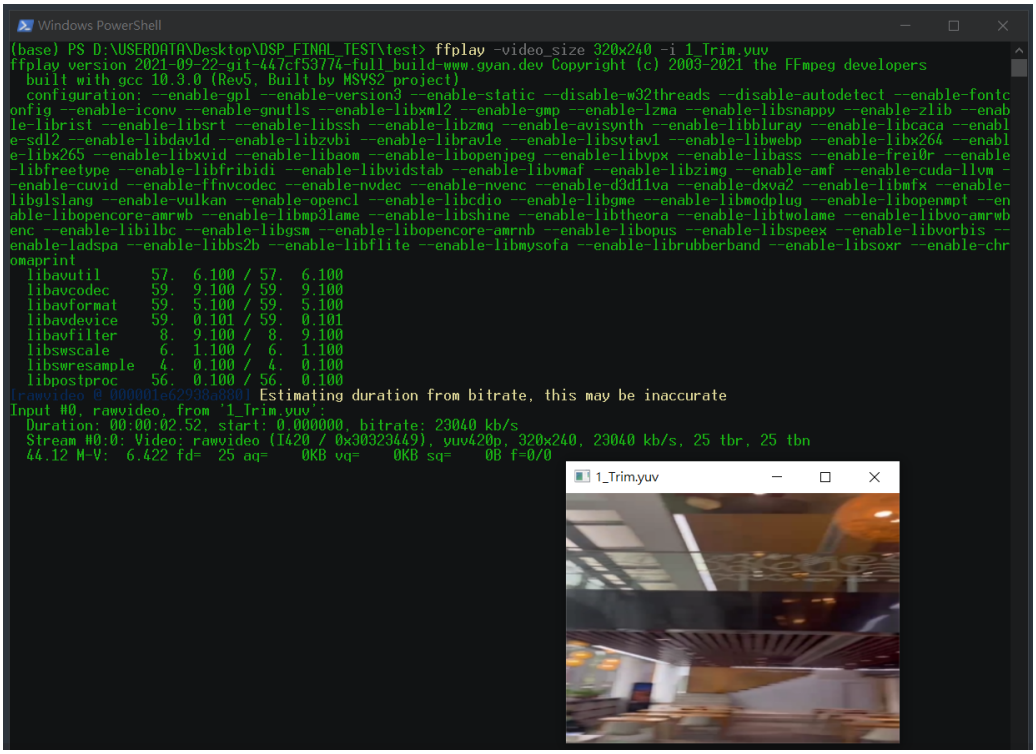

Fig. 2. 图书馆咖啡厅

Fig. 3. 图书馆旁的步道

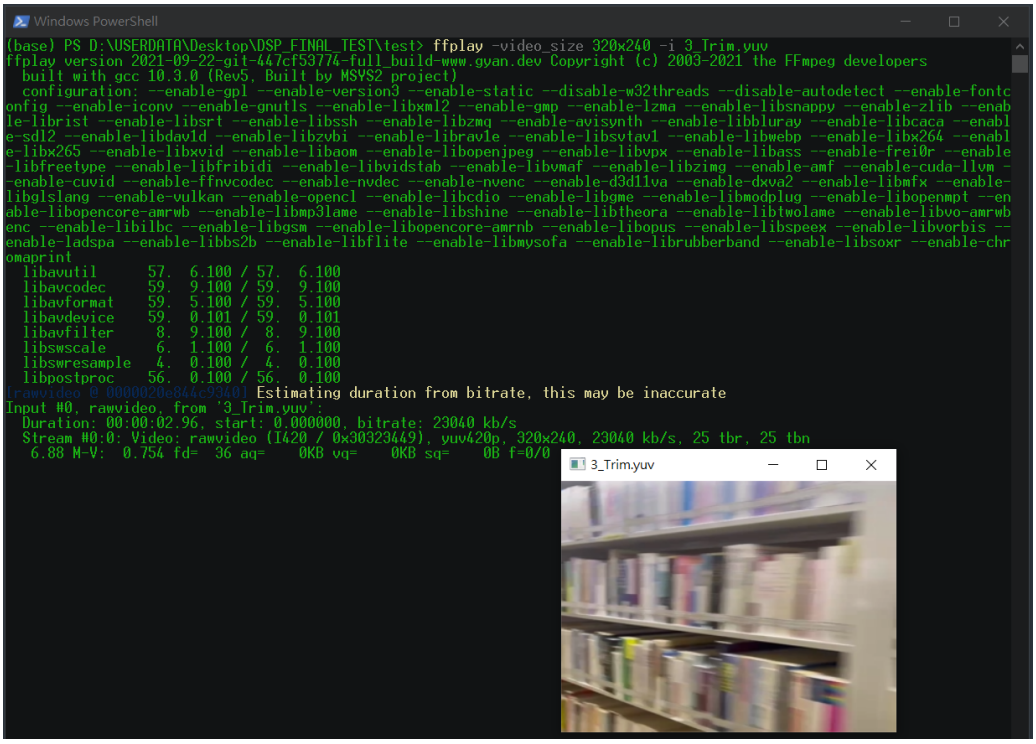

Fig. 4. 图书馆内书架陈列

Fig. 5. 图书馆旁的草皮

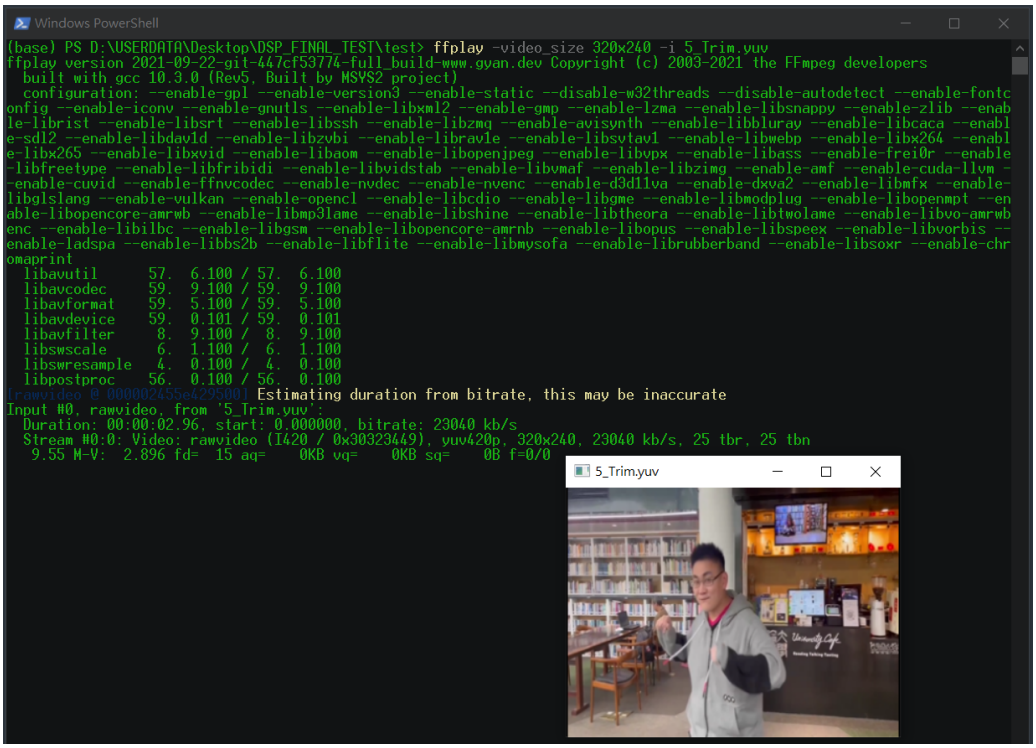

Fig. 6. 隐藏人物