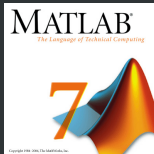


# WK Summer Camp 2009

## Animations in MATLAB and LATEX-Presentations



L<sup>A</sup>T<sub>E</sub>X

Sofi Esterhazy  
TU Wien



# Movies with MATLAB

- ▶ Why?
  - ▶ No need of MATLAB for presentations
  - ▶ Use of common multimedia players
- ▶ What formats?
  - ▶ Almost every
  - ▶ Restrictions by the methods used in MATLAB as well as by the operating system
- ▶ Presentation of two methods ...



# 1. Variant

## Using the innate MATLAB functions

```
%%Initializing
mov = avifile('movienam.avi')

%%Recording
for k = 0:end

    ...some commands depending on
    k, including a plot-command

    F = getframe(gcf);
    mov = addframe(mov,F);
end

%%Completion
mov = close(mov);
```

- ▶ Creates a movie in the **multimedia container AVI** (Audio Video Interleave)
- ▶ **Few modification parameters:** fps, keyframe, quality, . . .
- ▶ Only **'RAW'-Codec** on UNIX!!!  
⇒ Causes extremely big files
- ▶ Default **'Indeo5'-Codec** on Windows (UNIX-incompatible)
- ▶ Records directly from screen  
⇒ No other performances!!!



# Multimedia Containers

- ▶ file format, that contains different data types (audio/video data, subtitles,...)
- ▶ specifies only the way data are stored (but not coded) within the file
- ▶ Examples:
  - ▶ **Audio Video Interleaves (.avi)**: old, but compatibel (WIN, UNIX, MAC OS)
  - ▶ **Windows Media Frameworks (.wmv, .wma)**: Standard Windows-Container
  - ▶ **Apple QuickTime (.mov)**: Standard video container for Macintosh
  - ▶ **MEPG1,2 (.mpg, .mpeg)**: for VCD, SVDC
  - ▶ **MPEG4 (.mp4)**: Apple-QuickTime based data format (iPod, iPhone)
  - ▶ **Video Object (.vob)**: for DVD
  - ▶ **AIFF (.aiff)**: exclusiv audio container (Mac OS)
  - ▶ **WAV (.wav)**: exclusiv to still images (Windows)



# Codec compressions

- ▶ **Encodes** a data stream or signal for transmission, **storage or encryption**, or **decodes** it for **playback or editing**
- ▶ First: hardware that coded analog signals into digital data
- ▶ Nowadays: software for converting among digital signal formats, and including compander functions
- ▶ **Lossy compression**: reduce quality (color, motion, sound, etc.) by some amount in order to achieve smaller data sizes
- ▶ **Lossless compression**: used if data is to undergo further processing (for example editing)
- ▶ **Examples**:
  - ▶ **Video codecs**: Xvid, DviX, H.246, x264, . . . (all MPEG-4 based codecs)
  - ▶ **Audio codecs**: MP3, AAC, Ogg Vorbis, WMA



# 2. Variant

Using the VideoIO Toolbox of Gerald Dalley\*

```
%%Initializing
```

```
mov = videoWriter('moviname.mp4', ...  
    'fps', 25, ...  
    'showComprssionDialog', 1, ...  
    'codec', 'mpeg4', ...)
```

```
%%Recording
```

```
for k = 0:end
```

```
    ...some commands depending on  
    k, including a plot-command
```

```
    fig =(gcf;  
    addframe(mov,fig);
```

```
end
```

```
%%Completion
```

```
mov = close(mov);
```

- ▶ Framework: Requires **DirectShow** for Windows and the **ffmpeg library** for UNIX
- ▶ Much more modification parameters:
  - ▶ Height, width
  - ▶ fps, GopSize, bitRate, maxBFrames, . . .
  - ▶ Codecs:  
'mpeg1video', 'mpeg2video',  
'mpeg4', 'flv', 'rawvideo', . . .

\*<http://www.mathworks.com/matlabcentral/fileexchange/15224>



# Motion Picture Experts Group

## MPEG-1

- ▶ **Lossy** video format with multiple layers:
  - Part1: System
  - Part2: Video
  - Part3: Audio
- ▶ Including 3 audio layers:
  - MP1 ⇒ MiniDisc
  - MP2 ⇒ radio broadcasting
  - MP3 ⇒ data size reduction by a factor of 3, but still acceptable quality
- ▶ First compression standard of audio AND video
- ▶ Compress movies to fit on a compact disc ⇒ **VCD**

## MPEG-2 = H.262

- ▶ Broadcasting television quality
- ▶ **11 Parts** including HD support
- ▶ International standard compression scheme for DVB, digital cable TV, DVD,...

## MPEG-4

- ▶ High video compression
- ▶ **25 Parts** including:
  - Subtitle support
  - QT-based container format (.mp4)
  - Digital Rights Management



# How does MPEG work?

- ▶ **I-Frames:** Intra-frames, independent of any other frame, “keyframes”
  - baseline JPEG images
  - fast compression, large file size
- ▶ **GOP** = distance between two I-frames, default: 15-18 images
- ▶ **P-Frames:** Predictes frames, retains only difference from immediately preceding images
- ▶ **B-Frames:** Bidirectional-frames, uses both the previous and future frames
  - requires larger data buffers

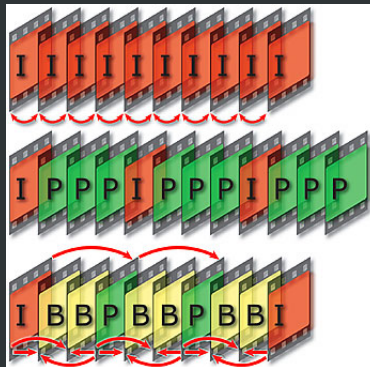


Figure: With the *Group of Picture Management* a group of pictures gets merged and compressed into a data packet of I-, B- and P-Frames

# Movies in LaTeX-Files

```
\begin {frame}[plain, label=Movie]
\frametitle{Show Movie}
\begin{center}
\movie[<options>]{\includegraphics
  [width=300pt, height=150pt]
  {./startpicture.jpg}}
  {./moviename.avi}
\end{center}
\end{frame}
```

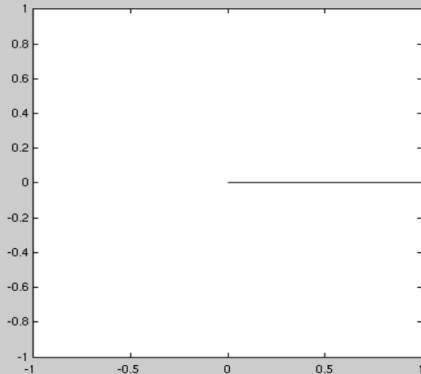
## Playback options:

- ▶ autostart
- ▶ loop = repeat
- ▶ once (default)
- ▶ palindrome
- ▶ showcontrols
- ▶ start =  $\langle times \rangle$ s, duration =  $\langle times \rangle$ s

- ▶ Beamer documentclass
- ▶ Packages: graphicx, multimedia
- ▶ PDF Viewer: Adobe Acrobat Reader, xpdf, . . .
- ▶ Mediaplayer: WMPlayer, QT-Player, VLC, . . .



# Show Movie



Thank you!

