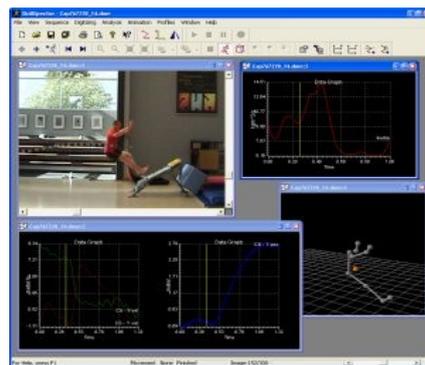


Movement analysis with SkillSpector

Version 1.0

Last update: 14/05-2008



What is SkillSpector

SkillSpector is a software program for video based movement analysis. The following analysis are available:

1. Direct movement analysis image for image.
2. Movement comparison through video overlay.
3. Kinematic movement analysis.

Direct movement analysis

Direct movement analysis is based on the simple option for image by image navigation in the video sequence. For most sports skills its certain position that's important which leaves this feature as the first step in skill analysis.

Video overlay movement analysis

Video overlay movement analysis gives the option to compare current movements with earlier executed movements. Hopefully it will show improved effect of the training.

Kinematic movement analysis

Kinematic movement analysis is a thorough analysis of positions, angles, velocity and so on. All analysis can be made on joints, segments and centre of gravity.

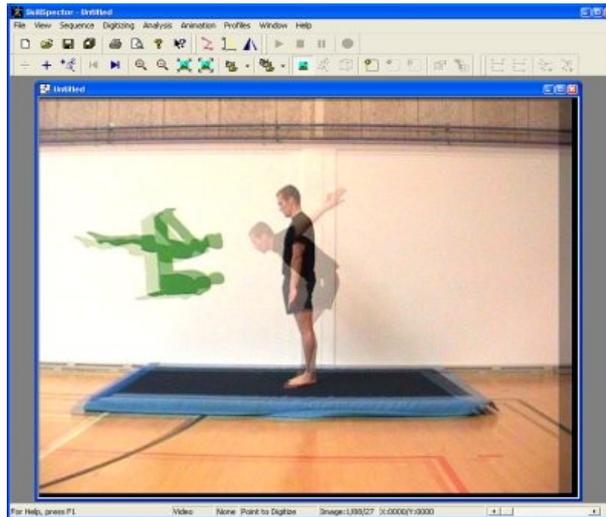
Movement walk through using video navigation

First step in movement analysis is the direct walk through image by image of the recording. This is done using SkillSpector in these easy steps:

1. Start SkillSpector
2. Create new SkillSpector sequence (File->New Sequence)
3. Open video file (Digitizing->Open Video (*.avi))

When the video is loaded it's possible to use the keyboard (right and left arrow) for image by image navigation in the video sequence. It's also possible to use the slider in the status bar (lower right corner of the software).

Video on Video movement comparison



It's possible to view 2 videos at the same time for comparison. This is the few steps to do the comparison analysis:

1. Start SkillSpector
2. Create new SkillSpector sequence (File->New Sequence)
3. Open video file (Digitizing->Open Video (*.avi)
4. Open "overlay" video file (Analysis->Overlay->Open Video (*.avi)

When both video files have been loaded it's possible to move the "overlay" video with respect to the original video file:

Physical position:

Press Shift and Ctrl button. Point and click the left mouse button in the video image and position the video by moving the mouse. When the mouse button is released the video position has been set.

Position in time:

Press Shift button. Use the left and right arrow button to move the overlay video image by image with respect to the original video.

Changing the amount of overlay (opacity):

It's possible to change the amount of image overlay also called opacity. Press the shift button and use the up and down keys to change the opacity.

Kinematic movement analyse

Video based kinematisk movement analysis is done in the following steps:

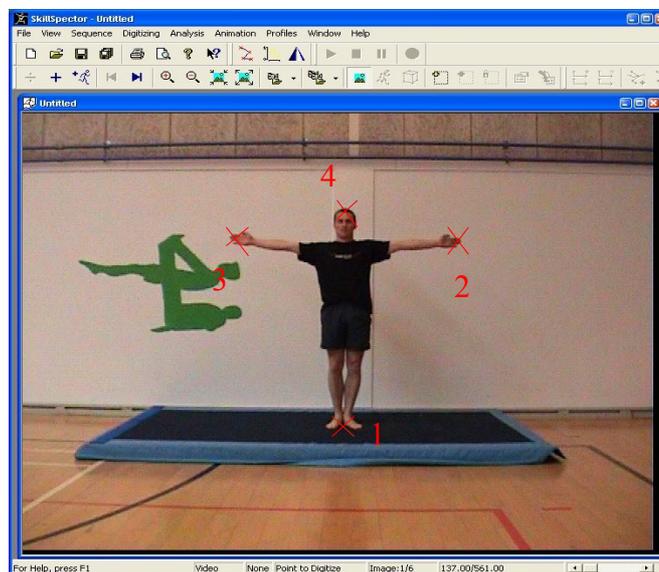
1. Filming of the movement
2. Filming of the calibration object
3. Video capture
4. Digitizing of the movement
5. Digitizing of the calibration object
6. Data analysis

If SkillCapture is used it's possible to combine both filming and capture and go straight to the digitizing process.

Calibration object

In order for SkillSpector to calculate the kinematic information (absolute position of choosen points) a calibration object is used with at least 4 positions known. The object could be of any shape but most often a square frame. Important for the calibration frame/object is that it's stable and does not change form or size.

As an alternative it's possible to use you own physical person as a calibration object. This type of calibration is not very accurate but can be used in repeatable attempts with the same person or as a fast alternative before the design of a complete study. The calibration using you own person is based on the fact that you height is equal to the length between the fingers. The only input is the persons height.



Digitizing this type of calibration object the following positions has to be marked:

1. Heels – Middle of the feet
2. Right finger tip
3. Left finger tip
4. Top of head

Filming of the movement

In order to use the video sequence for kinematic analysis it's important that the camera is perpendicular to the movement. Also it's important that the camera is not moved during filming.

It's not possible to use wide angle lenses if kinematic analysis is performed.

Filming of the calibration object

Place the calibration object at the same position as the movement was performed. Only a short sequence is needed.

Video capture

The filming can be captured to the computer in different ways. If SkillCapture is used the video files is directly accessible on the hard drive. If SkillCapture for some reason can not be used alternative software (like VirtualDUB or MovieMaker) can be used to capture the filming. Important is that the video files is captured as AVI files.

Create new SkillSpector Sequence

When you work with movement analysis in SkillSpector it's important to understand where the information is stored. As with a Word document all kinematic data is stored in a file on the harddrive. The only information that is not stored in the SkillSpector data file is the actual video. The only thing stored in the SkillSpector data file about the video is the name and the location. Thus it's important to keep the SkillSpector data file and video files close together.

A new SkillSpector sequence file is created by activating in the menu: File->New Sequence

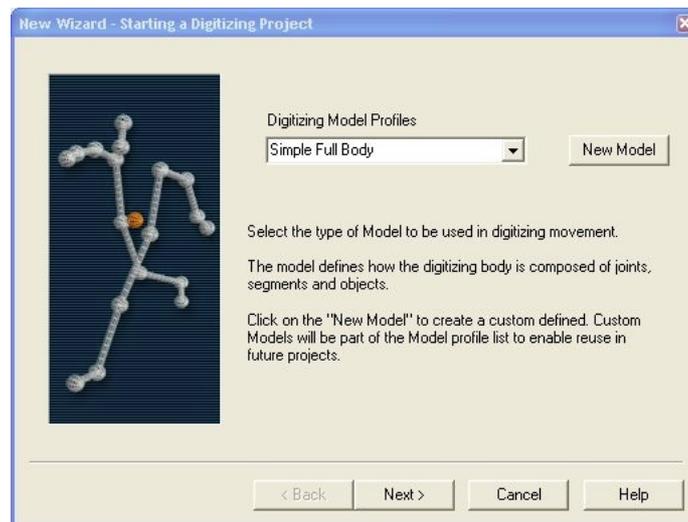
Open video file

When creating a new SkillSpector sequence there is no video file associated. In order to associate a video file (the movement) activate in the menu: Digitizing->Open Video (*.avi)

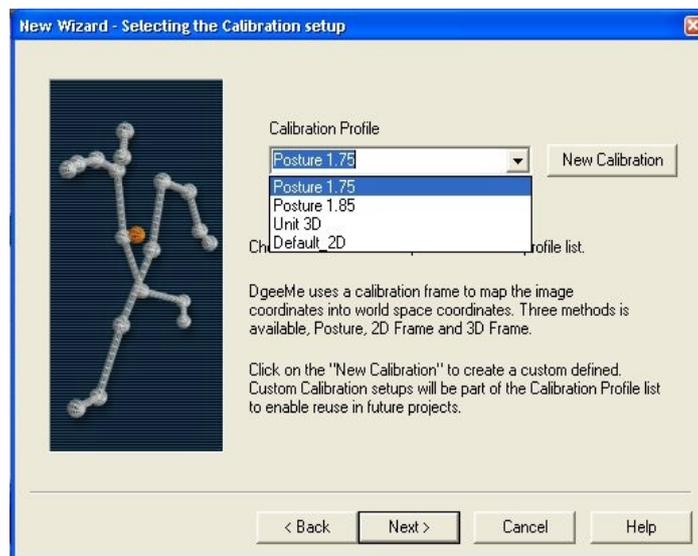
By 3D analysis it's important with multiple "views" of the same movement in order for to calculate the correct movement information. For 2D movement analysis it's important only to associate one video file.

Definition of model and calibration

Activate from the menu: Sequence->Model Wizard



Choose from the list “Digitizing Model Profiles” the model that is needed for the analysis. It could be something like left leg, right side or maybe full body model where all body joints has to be digitized. When the model has been chosen select “Next”.



Choose from the list “Calibration Profile” the object that has to be used of calculating the kinematic information of the movement. The calibration can be changed at any time during the analysis but the model can not.

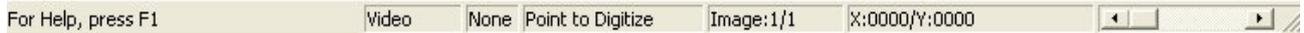
It's important to choose the correct digitizing model from the start. After the digitizing has been started it can not be changed.

Digitizing of the movement

In SkillSpector there is three different “Modes”: Video viewing, Digitizing Movement, Digitizing Calibration. When SkillCapture is in “Video Viewing its possible to do direct video navigation and video overlay analysis. In digitizing Movement it's possible to digitize movement and in Digitizing Calibration it's possible to digitize the calibration object.

In this first phase it's the movement that we need to digitized activate from the menu: Digitizing-

>Mode->Movement.



From the status bar it's possible to follow the positions that needs digitizing. The name of the position will displayed in the field "Point to digitize". To the left of "Point to digitize" the side (left, right, none) will be displayed.

A position of the movement is digitized by moving the mouse to the position (displayed in "Point to Digitize") in the video image and the left mouse button is clicked.

In some situation it can be difficult to the accurate position but there is several options to improve the digitizing.

Zoom

A common method to get closer to the position is to use the zoom. In SkillSpector every position to be digitized has it's own zoom and scroll position. This means that SkillSpector adjusts zoom and scroll position according to what previous has been defined.

If it's need that all positions uses the same zoom and scroll position it can be done from the SkillSpector context menu. The context menu is activated by clicking with the right mouse button in the video image. In the menu that shows the item "Freeze Zoom/Position" is used.

Sneak Zoom



Sneak Zoom is another alternative to zoom. In some situations it's necessary to have good view of the complete movement but still need to zoom to view the actual position to digitize. Sneak Zoom is an option that is activated by holding down the left mouse button close to the position to digitize. After a short time a small zoom window will show. In this window it's possible to find the accurate position. If the position can not be found in the sneak zoom window the mouse is just moved out of the window and released.

If the mouse button is released inside the sneak zoom window the point is digitized.

Open calibration video

In order to work with the calibration object it's important the you switch to SkillSpector's calibration Mode. This can be done through the menu: Digitizing->Mode->Calibration or using the toolbar.

If the calibration object is not in the same video file as the movement its possible to open the video file with the calibration object. Open the calibration video file using the menu: Digitizing->Open Video (*.avi).

Digitizing of the calibration object

Digitizing the calibration object it's important that the correct position is found and that the points defined in the object is followed from 1 to the last point.

Using Posture calibration 4 positions has to be digitized:

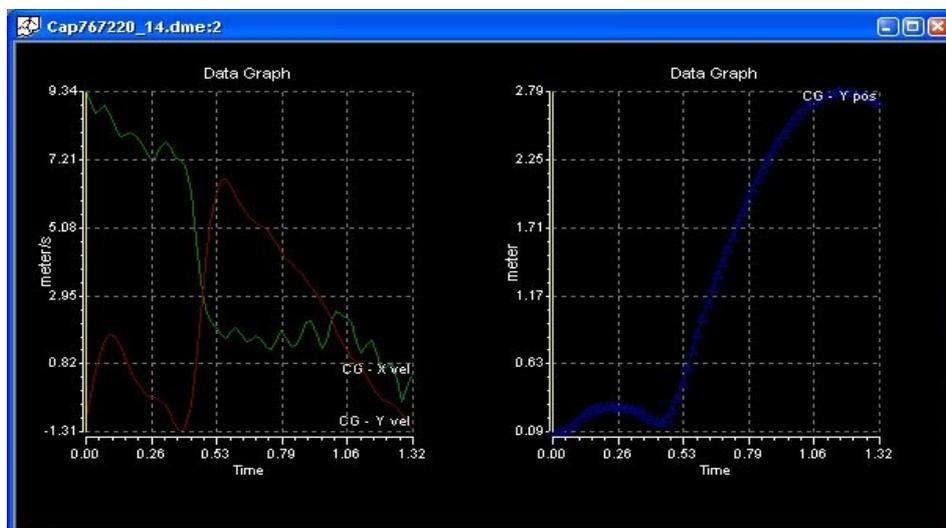
1. Middle of feet (heels)
2. Right finger tip
3. Left finger tip
4. Top of head

Calculation of the kinematic movement information

After the digitizing of the calibration object the switching to Movement will ask for calculation of the kinematic movement information. (Transform Data?). If everything is ready just activate "Yes".

Data analysis

After the kinematic information has been generated it's possible to view a lot of different data of the movement.



1. Position, velocity and acceleration.
2. Joint angle, joint angle velocity and joint angle acceleration.
3. Segment angle, segment angle velocity and acceleration.
4. Inertia

For all information under 1 it's also possible for certain models to analyse the centre of gravity. All analysis can be opened from the menu Analysis.