Theia Directory Management

User Manual

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# Intent

The Theia Directory Management App is intended to help manage video and other files needed for markerless motion capture with Theia Markerless. In motion capture labs these files can be numerous, spread across different folders. It can be an arduous task to format the folders as needed for Theia and distribute other processing files to them. This app is intended to help with that management.

# Scope

As of 10/14/2022 this app is still in development. It has been created for use in an academic research environment, which can change significantly over time. And so, the scope of this app will likely change and adapt to that environment. Currently it is designed to help manage video files recorded by Qualisys Track Manager in the Boston University Movement and Applied Imaging Laboratory (BU MoveLab). It has been designed around the equipment available and the practices involved.

# Overview

TDM App is designed in MATLAB 2021b. It allows for 1) organizing video files into a specific directory structure, 2) assessing a new or existing directory for known problems, and 3) distribution of preferences files for Theia. These functionalities are organized into three tabs within the app. Video files can be moved to a new folder or reorganized in the folder they are in. Calibration files can be checked for incompatibilities with Theia and distributed to the correct folders. Theia can load processing parameters from a preferences file, and these can also be distributed to the correct folders.

# Future Work

1. The app is not designed to work with other systems or folder structure. This capability could be incorporated. Theia does assume a certain level of organization involving video files. TDM App would also need to assume a level of organization or common use. It cannot be a solution for mismanagement or careless organization.
2. There is an error related to the use of Qualisys Micus and Oqus video cameras and different fields-of-view they may have. Theia cannot process video data with varied fields-of-view.
3. Qualisys periodically drops video frames. There may be other issues with this but mainly Theia cannot process multiple videos from a single capture but with different numbers of frames. It would be good for TDM to be able to find these issues so they can be explored and potential fixes identified.
4. Video files are only copied now. An option to copy or move them would be useful. The copy function is currently used until confidence with the app is more than sufficient.
5. There is no solution for multiple calibrations performed on the same day. The app is designed assuming only one calibration file is present for a single day.

# Using TDM

## Management

One of the main steps before using Theia is to have the video files organized into a specific folder structure. Be sure to read the Theia documentation on this for other relevant details. In short, each video file must be contained in a folder named with the serial number of the camera, with all video folders contained within the same recording folder. At this level the suggested directory structure becomes specific to the subject, action and subject group. The app is designed to work with the folder structure as it is currently created. So if there are deviations from Theia’s suggestions these will be retained.

Graphical user interface, text, application, email

Description automatically generated

Figure 1

This is the Management tab of the app and is the main interface for the user. Details on using each of the buttons and fields can be found within this section of the user manual.

### Select Source Directory

One of the first steps is to select the source directory for the video files. This entire directory will later be searched for avi files. It can be different from the Target Directory or it can be the same. The overall structure of the directory will remain the same.

### Filter for Inclusion and Exclusion

Tags can be entered into these fields to filter video files during the search. Mismatches between video and calibration files will cause an error in Theia. It is up to the user to enter an exclusion tag to remove these video files from the search. An example would be the use of an Oqus video camera with a Qualisys motion capture system. The app will recognize model 210 Oqus cameras and remove them from the calibration files. However, the user must exclude them during the file search.

Tags should be entered separated by commas without spaces. The inclusion tags are treated as an AND() operation while the exclusion tags are treated as an OR() operation. Those tags must be found within the file names of the video files. This aspect is specific to Qualisys, which uses the trial names, camera type and serial number in the file names.

### Select Target Directory

This is the directory where the video files will be organized. It can be the same or different from the Source Directory. The overall folder structure will be reproduced from the Source Directory but will only include the video files. This is intended to add flexibility for varied experimental procedures.

### 1 Find Video Files

This button will start the file search process. This is a recursive method that will search the entire Source Directory, subfolders included, for avi files. Once complete the files will be listed in the table. This process can take a long time, >10-15 min, for large directories. So, it is recommended to try it on a smaller directory first and make sure the results are as desired. A message notifying the start and end of the search will be displayed in the log window. To help anticipant data transfer times and load the completion message will also display how many files have been found and their collective file size.

It should be noted that if the Find Video Files is pressed again before a previous search process has been completed the results may not be as expected. What happens depends on how quickly those concurrent searches are proceeding. If a search needs to be stopped it is best to close the app and reopen it.

Graphical user interface, text, application, email

Description automatically generated

Figure 2

Example file search results. This directory has already been organized for Theia. Note that the Target Directory is not filled and is not a requirement for the file search.

### 2 Assess Target

The second step will assess the target directory for completion. It will not detect errors. It will determine if 1) the video files found in the Source Directory are also located in the Target Directory, 2) if calibration files are present, and 3) if preferences files are present. This process is generally quick as it is only looking for the presence of files. It is most useful when a dataset is to be processed but is not complete. When more data is added some of the assessed files may not be present. This method will help detect and correct those. When finished the results will be displayed in the table. If a calibration file is found in the correct locations within Target Directory a 1 will be displayed. Calibration files are expected to contain the string ‘qca.txt’. This is specific to Qualisys. Likewise, a 1 will be displayed if a preferences file is found. These will have a ‘.pxt’ file extension as specified by Theia. If the video files exist that column will also contain a 1. When finished the log window will display the completion percentage of each file type.

Graphical user interface

Description automatically generated with medium confidence

Figure 3

Example results of Assess Target. This folder has already been organized for Theia. Unlike Figure 2 the Source Directory is not organized for Theia.

### 3 Transfer Files

This button will copy the files from the Source Directory to the Target Directory. This may take some time. It will take longer if data is stored on a network drive compared to a local hard drive in the computer. The log window will provide a periodic update on the progress of the transfer. Files that already exist in the Target Directory will be skipped. This is intended to save time when managing large datasets and organizing them as additional data is accumulated. If the files need to be re-transferred, such as due to a prior processing step, the files in the Target must first be deleted or renamed.

Graphical user interface

Description automatically generated with low confidence

Figure 4

This is an example of a transfer process being conducted. Updates to the command window will be printed every 10 files and at the completion of the transfer. The final message will also state how many files were transferred.

### Transfer Calibration Files

This button will transfer calibration files to the Target Directory. This process is specific to Qualisys and the procedures at the BU MoveLab. Other users with similar processes may still be able to use this functionality. Theia requires that the calibration files for a capture are located within that folder. It is time consuming to move these calibration files to the correct folders of a large dataset without some assistance from a program. TDM App is intended to perform this transfer and fix known incompatibility issues between Theia and Qualisys calibration files.

Qualisys uses a particular structure for its Projects. Recordings are saved to a Data folder and calibration results are saved to a Calibration folder. The Source Directory must contain this ‘Data’ folder within its structure. TDM will find it and assume the ‘Calibration’ folder is also contained in the parent directory. This does allow subfolders with ‘Data’ to be processed as the Data folder needs only to be somewhere in the path. Qualisys calibration files are saved as a binary format (qca) and must be converted to text. This is best done immediately after the calibration. The qca-files can be reopened in QTM to perform a calibration from the recording, and then export the text files. These files will contain the date of the calibration and will be matched to the dates in the video files. Those dates are expected to be first located after the first underscore in the file name. If that is not found the date is assumed to be the parent directory of the recording. All dates are expected in a YYYYMMDD format. These options are shown in Figure 8.

Once the dates are matched the calibration file will be loaded as an xml and modified to fix known compatibility issues with Theia. Two fixes are currently applied. Any 210c Oqus cameras are removed from the calibration file. Micus hybrid cameras may have different field-of-view settings between their marker and video modes. If these are different Theia will throw an error and be unable to process the file. TDM will make the marker field-of-view settings the same as the video, which should be inconsequential to further processing. A fix is also pending for mismatched fields-of-view between cameras. When finished an xml file will be written to the correct locations in the Target Directory as a calibration file.

A screenshot of a computer

Description automatically generated with medium confidence

Figure 5

This screenshot displays the directory contents for a single recording. The folders are named after the serial numbers of cameras, and each contain a single video file. The calibration file ends in qca.txt. It contains the same date as the parent directory. Also seen here is a pxt-file, which is the local preferences file that Theia will use to process the data.

Graphical user interface, text

Description automatically generated

Figure 7

This is an example Project directory created by QTM. TDM assumes the Data and Calibration folders created by QTM will be found here and will contain the video data and calibration files respectively.

A screenshot of a computer

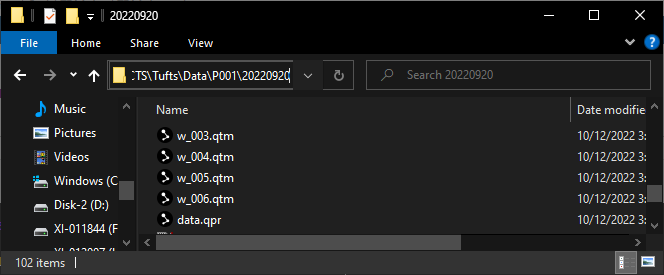
Description automatically generated with medium confidence

Figure 8

These panels display the file naming TDM is currently designed for. First it assumes the files are named as on the left, where the date is in a YYYYMMDD format and is after the first underscore in the file name. The second option on the right has the date within the parent directory of the recordings.

Graphical user interface, text, application, chat or text message

Description automatically generated

Figure 9

The screenshot shows completed qca-files and exported qca.txt-files containing calibration data from QTM. The text files are needed to run Theia.

### Distribute Preferences

Theia can batch process video data using local preferences files. To do this those files must be located within the folder for each recording. Distribute Preferences will use the files specified in the Preferences tab to distribute them into the Target Directory. This process generally proceeds quickly.

Export Assessment

This button will export the current table in the Management window to an Excel file. This is primarily useful if an assessment has been made and the results need to be used outside the app to solve problems with the video files.

## Assessment

After a target has been assessed using Assess Target the Assessment tab can be used to find issues. This is most useful with large datasets and infrequent problems. To begin the process select Start. The three panels will then display information for missing video, calibration or parameter files. The video files that are missing will have their file name displayed. Missing calibration files will have the date of the expected calibration and the subject identifier displayed. The subject identifier and date are expected to be the parent directories of the recording, as displayed in previous figures. Recordings that are missing parameter files will be displayed. TDM does assume that ‘Micus’ will be found in the file names. These and the serial numbers are removed and only the unique recording names are shown.

Graphical user interface

Description automatically generated

Figure 10

The screenshot shows an example assessment. The video files listed in the left panel are missing from the Target Directory. The middle panel indicates subject P002 is missing a recording for October 5th, 2022. The right most panel indicates trials w\_001 and w\_002 are missing parameter files. In this example the Oqus and another video camera were not removed using exclusion tags. So TDM identified them as also missing parameter files.

## Preferences

Theia can use a preferences file to specify various processing parameters. Various parameters may be desired for different trials. An example is walking compared to running or quiet standing. These files must be located in each of the trial folders. This is the same location as the calibration files. With a large and variable dataset it can be difficult to move different files to the right locations. TDM is designed to help with this. The Preferences tab allows a user to select different preferences files for the app to distribute through the Management tab. The file name of the preferences files will be used as a tag to search for related captures in the Target Directory. In Figure 11 a file named bal.pxt has been loaded into TDM. When distributed this file will be copied into any recording folder with ‘bal’ in the name. Multiple parameter files can be loaded into TDM and distributed.

Graphical user interface, application

Description automatically generated

Figure 11

This is an example of a selected preferences file that will be distributed to any recording folder with ‘bal’ in the name.

# Acknowledgements

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