OT_Temporal_Alignment

This application receives a sequence from both a Realsense device and an Optitrack system (=GT) and synchronizes between the timestamps received from the 2 systems clocks. The synchronization result is a shift delta between the 2 clocks.

The synchronization can be done in one of the following 2 methods:

1. Start movement detection. In this case the alignment might be based on color images / fisheye images / gyro sensor data / accelerometer sensor data.
2. Recommended: Best fit alignment - Finding the timestamps delta which gives the best fitness between a GT sequence and a source sequence. In this case the alignment might be based on 6dof data achieved by algorithm running on device or on gyro sensor data.
   In this method, in addition to finding the delta, the tool performs an interpolation process to provide exact GT according to source timestamps.

Dependencies

- $/SW/CVL/Tools/3rdparty/opencv/310

Supported Configurations:

- Compiler : vc120 / vc140 (recommended)
- Running mode: x64 only. (due to opencv 310 constraints)
- Recommended IDE: visual studio 2015.

Location in Flow

This application should run after the recording process has ended. The input to this application is the GT recorded files and the device data according to the wanted temporal alignment:

- For alignment based images (detect start of movement): a folder with images (color / fisheye) extracted from record file (RC…)

- For alignment based 6dof data: a 6dof file in TUM format with 'txt' extension.
- For alignment based gyro data: a file with gyro data in a format given by RC_exporting tool.
- For alignment based accelerometer data: a file with accelerometer data in a format given by RC_exporting tool.

Usages:

Parameters:

- *Required:*
  - -folder <path> a path to input files folder.
  - -rb <name> name of the camera rigid-body (e.g. "TM2_SLAM_ES3")

  For start movement detection:

  - -color | -fe | -gyro | -acc   The RealSense stream (one or more) for syncing with Optitrck (ealiest of chosen streams).
    - -color sync to the Realsense RGB stream
    - -fe   sync to the Realsense Fisheye stream
    - -gyro sync to the Realsense angular velocity(gyrometer) stream
    - -acc   sync to the Realsense linear acceleration(accelerometer) stream

  For best fit alignment

  - –ta <param1_param2_param3_param4> parameters which describe the best fit alignment process, separated by '_', according to the following specification:
    - Param1 – the source type. Options: gyro / 6dof.
    - Param2 – comparison section length from source data. Units: seconds. Default: 100 sec. if this parameter is bigger than possible (source data is shorter) the comparison will be done to the maximum possible length.

- Param3 – user guess for initial delta. Units: milliseconds. Default: 0 Ms. This value will be added to the automatic initial delta which is the difference between the first two timestamps.
- Param4 – amplitude size to move to each direction (negative and positive) from initial guess when looking for best fitness. Units: milliseconds. Default: 30000ms.

  Note: the first parameter is required. The others are optional.

- Optional:
  - for help menu: -help

  <u>For best fit alignment</u>

  - –src <path relative to given folder> a path to the source file (6dof or gyro) in relative to the given folder *not including the 'txt' extension*. Default: in case of 6dof based alignment: looks for a file in the given folder with "txt" extension. In case of gyro based alignment: looks for an inner folder with the prefix "extract" and looks for a gyro.txt file in this folder.
  - – interp <interpolation type> one of the 3 options: linear, nearest and none. Default is: linear.
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<u>Examples for start movement detection:</u>

 -folder "C:\Users\ntuser\Documents\TFS\CVL\Tools\GTool\PostProcessing\OT_TemporalAlignment\without rendering" -rb "DoubleDome" –color

This command will perform the temporal alignment process on the files in "C:\Users\ntuser\Documents\TFS\CVL\Tools\GTool\PostProcessing\OT_TemporalAlignment\without rendering", when the camera rigid-body poses file is 'DoubleDome_RigidBody.txt'. The synchronization will be done according to color images.

<u>Examples for best fit alignment:</u>

-folder "Z:\forAviva\handeye\calib_ctrl1\gyro_temporalAlignment_controller"
-rb Controller029 -ta "gyro_200_0_50000" -src "extracted\gyro_ctrl"

This command will perform the temporal alignment process on the files in "Z:\forAviva\handeye\calib_ctrl1\gyro_temporalAlignment_controller ", when the camera rigid-body poses file is 'Controller029_RigidBody.txt'. The synchronization will be done according to gyro data from file "Z:\forAviva\handeye\calib_ctrl1\gyro_temporalAlignment_controller\extracted\gyro_ctrl.txt". The comparison will be done on a section of 200 seconds length with user guess 0f 0 and with 50000 ms amplitude to every direction. In addition to the temporal alignment process, a linear interpolation process will be executed too.

Input:

The app should receive a path to a folder with all needed files inside. The folder should include the next components:

- A text file with poses for every wanted OT recorded object.

   Naming convention:

   - a file of a rigid-body poses should be named: [rigid-body name]_RigidBody.txt e.g. "CB_Rigidbody.txt"
   - a file of labeled markers should be named "LabledMarker.txt"
- Relevant data depending on the selected temporal type:
  - For color/fisheye alignment – a folder with the extracted color/fisheye images inside + text files with the stream data.
    Note: Recorded dataset should start with a static scene (for at least 100 frames / samples)
  - For gyro alignment – a text file with the gyro sensor data.
    - In start movement detection – a file in the known 'folder format' format
    - In best fit alignment – a text file in RC_exporting tool format

- For accelerometer alignment – a text file with the accelerometer sensor data in the known 'folder format' format.
  All these files need to be located in an inner folder:
  - In start movement detection – With the name 'extracted_[rssdk/rc file name]', e.g. "extracted_rssdk1".
  - In best fit alignment – with the prefix 'extract', e.g. "extracted"

To watch an example of a full folder with all needed files inside, go to:

- **For start movement detection:**
  $/SW/CVL/Tools/GTool/PostProcessing/ OT_TemporalAlignment /example_input_folder_SMD
- **For best fitness alignment:**
  $/SW/CVL/Tools/GTool/PostProcessing/ OT_TemporalAlignment /example_input_folder_BFA

Output:

The app provides a folder named "temporalAlignment" with a text file for each OT file with new time stamps which are aligned to the device time stamps. The files are in the same format as in the input files and the same names apart from the prefix "TA_".

In best fitness alignment only, in addition to those files, the tool provides a logger file which describes the alignment process, and files with the GT data aligned and interpolated to the source data. These files are with the prefix "inter_". (in case the interp parameter was not to set "none").

To watch an example of a full folder with all needed files after running the temporal process, go to:

- **For start movement detection:**
  $/SW/CVL/Tools/GTool/PostProcessing/ OT_TemporalAlignment /example_output_folder_SMD

- **For best fitness alignment:**
  $/SW/CVL/Tools/GTool/PostProcessing/
  OT_TemporalAlignment /example_output_folder_BFA