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ln[ ]:= (**Input identifying information**)

ln[ ]:= date = ToString[Evaluate[Input["Input the date of the experiment"]]]

ln[ ]:= mouse = ToString[Evaluate[Input["Input the mouse identity (e.g. Mouse123)"]]]

ln[ ]:= sessionNum = Evaluate[Input["Input the session number"]]

ln[ ]:= (**Import the frame times for the 2P images and calculate the frame rate**)

ln[ ]:= tpFrameTimes =
  Drop[Drop[(Import[StringJoin["S:/Imaging/Garrett/FMB208_2PRig/", date, "/",
    mouse, "/Session", ToString[sessionNum], "/", date, "_", mouse, "_",
    "Session", ToString[sessionNum], "_2PFrameTimes.txt"], "List"), 16], -1];

ln[ ]:= tpFrameRate = Round[Length[tpFrameTimes] / (Last[tpFrameTimes] - First[tpFrameTimes])];

ln[ ]:= (**For each ROI picked for the session, upload the extracted dF/F0 time series**)

ln[ ]:= rois = Import[StringJoin["S:/Imaging/Garrett/FMB208_2PRig/", date, "/",
  mouse, "/Session", ToString[sessionNum], "/", "Pupil/", date, "_", mouse,
  "_", "Session", ToString[sessionNum], "_pupilModROIs", ".txt"], "List"];

ln[ ]:= (**Upload the time intervals of the pupil dilation-
  constriction events. The first element is pupil dilation onset**)

ln[ ]:= dilationConstrictionPeriods =
  ToExpression[Import[StringJoin["S:/Imaging/Garrett/FMB208_2PRig/", date, "/", mouse,
    "/Session", ToString[sessionNum], "/", "Pupil/", date, "_", mouse, "_", "Session",
    ToString[sessionNum], "_quiescentDilationConstrictionTimePairs.txt"], "List"]];

ln[ ]:= dilationStarts = First /@ dilationConstrictionPeriods;

ln[ ]:= constrictionDilationPeriods =
  ToExpression[Import[StringJoin["S:/Imaging/Garrett/FMB208_2PRig/", date, "/", mouse,
    "/Session", ToString[sessionNum], "/", "Pupil/", date, "_", mouse, "_", "Session",
    ToString[sessionNum], "_quiescentConstrictionDilationTimePairs.txt"], "List"]];

ln[ ]:= constrictionStarts = First /@ constrictionDilationPeriods;

(**Import the quiescent intervals**)

quietBaselines =
  ToExpression[Import[StringJoin["S:/Imaging/Garrett/FMB208_2PRig/", date, "/",
    mouse, "/Session", ToString[sessionNum], "/", "LocomotionData/", date, "_",
    mouse, "_", "Session", ToString[sessionNum], "_QuiescentBouts.txt"], "List"]];

(**Find periods at least 5 seconds in length in the quiet baseline intervals
  that were not associated with significant pupil dilation or constriction**)

ln[ ]:= noPupilChangesIntervals = {};

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Table[list = Table[If[Length@Flatten[Position[
    IntervalMemberQ[#, tpFrameTimes[[i]]] & /@dilationConstrictionPeriods, True]] ==
    0 && Length@Flatten[Position[IntervalMemberQ[#, tpFrameTimes[[i]]] & /@
    constrictionDilationPeriods, True]] == 0, {1, i}, {0, i}],
    {i, Flatten[Position[tpFrameTimes, Nearest[tpFrameTimes, quietBaselines[[n, 1]]][[
    1]]][[1]], Flatten[Position[tpFrameTimes,
    Nearest[tpFrameTimes, quietBaselines[[n, 2]]][[1]]][[1]], 1]];
sameElementList = SplitBy[list, First];
longPositions = Flatten[Position[Length /@ sameElementList, _? (# > 5 * tpFrameRate &)]];
longPosIntervals = Table[{First[sameElementList[[k]][[All, 2]]],
    Last[sameElementList[[k]][[All, 2]]]}, {k, longPositions}];
longTimeIntervals = Table[Part[tpFrameTimes, #] & /@ longPosIntervals[[j]],
    {j, 1, Length[longPosIntervals]}];
noPupilChangesIntervals = Flatten[Append[noPupilChangesIntervals, longTimeIntervals]];
{n, 1, Length[quietBaselines]}];

In[ ]:= noPupilChangesIntervals = Partition[noPupilChangesIntervals, 2];

In[ ]:= (*****
    (*****Import and handle pupil data*****)
    (*****)

In[ ]:= (***Import the raw pupil radius time series***)

In[ ]:= pupilTimeSeriesBef =
    ToExpression[Import[StringJoin["S:/Imaging/Garrett/FMB208_2PRig/", date, "/",
        mouse, "/Session", ToString[sessionNum], "/", "Pupil/", date, "_", mouse, "_",
        "Session", ToString[sessionNum], "_PupilRadiusTimeSeries.txt"], "List"]];

In[ ]:= timeVals = Part[#, 1] & /@ pupilTimeSeriesBef;

In[ ]:= (***Create pupil diameter time series,
    excluding NaN elements from edge detection abnormalities***)

In[ ]:= pupilTimeSeries =
    DeleteCases[Table[If[NumberQ@pupilTimeSeriesBef[[n, 2]], {pupilTimeSeriesBef[[n, 1]],
        pupilTimeSeriesBef[[n, 2]]}, Null], {n, 1, Length[pupilTimeSeriesBef]}], Null];

In[ ]:= (***Interpolate the pupil diameter time series and resample at 10 Hz***)

In[ ]:= pupilInterp = Interpolation[pupilTimeSeries];

In[ ]:= pupil10Hz = Table[pupilInterp[t],
    {t, First[pupilTimeSeries][[1]], Last[pupilTimeSeries][[1]], 0.1}];

In[ ]:= pupil10HzTimeSeries = Partition[Riffle[Table[n,
    {n, First[pupilTimeSeries][[1]], Last[pupilTimeSeries][[1]], 0.1}], pupil10Hz], 2];

In[ ]:= pupil10HzInt = Interpolation[pupil10HzTimeSeries];

quietPeriods = quietBaselines;

(***Create a distribution of pupil sizes during the quiet baseline periods***)

quietPupilSizes = Flatten[Table[Table[pupil10HzInt[t],
    {t, quietPeriods[[n, 1]], quietPeriods[[n, 2]], 0.1}], {n, 1, Length[quietPeriods]}]];

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In[ ]:= (**The upper pupil-size threshold is the 3rd quartile
         of the quiescent pupil size distribution. The lower pupil-
         size threshold is the median of the quiescent pupil size distribution.**)

lowerPupilThresh = Median[quietPupilSizes];

In[ ]:= (**Calculate the median pupil diameter during the NoPupilChange
         intervals and keep the intervals for which the median is below
         the median of the full quiescent pupil diameter distribution**)

In[ ]:= noChangeIntervalMedians =
        Table[Mean[Table[pupil10HzInt[t], {t, noPupilChangesIntervals[[n, 1]],
                        noPupilChangesIntervals[[n, 2]], 0.1}]], {n, 1, Length[noPupilChangesIntervals]}];

In[ ]:= lowDiamIdentity = Table[If[noChangeIntervalMedians[[n]] < lowerPupilThresh, 1, 0],
        {n, 1, Length[noChangeIntervalMedians]}];

In[ ]:= lowDiamPositions = Position[lowDiamIdentity, 1];

noPupilChangesIntervalsLowPupil = Extract[noPupilChangesIntervals, lowDiamPositions];

In[ ]:= Export[StringJoin["S:/Imaging/Garrett/FMB208_2PRig/", date, "/", mouse, "/Session",
        ToString[sessionNum], "/", "Pupil/", date, "_", mouse, "_", "Session",
        ToString[sessionNum], "_lowPupilBaselines", ".txt"], noPupilChangesIntervalsLowPupil];

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