

Analysis Script Execution and Result Directory Mapping

Overview of the Python-Based Correlation Analysis Pipeline

1. Purpose

This document describes how each Python analysis script is executed and how its outputs are organized into corresponding result directories.

The purpose of this guide is to provide a **clear one-to-one mapping** between:

- analysis scripts,
 - console execution steps, and
 - generated result folders and files.
-

2. Analysis Directory Overview

All analysis scripts and input data are located in a single working directory.

Figure 1. Overall directory structure containing Python analysis scripts, input video, and result folders.

이름	수정한 날짜	유형
guide	2025-12-22 오후 2:08	파일 폴더
results_compare	2025-12-18 오후 11:55	파일 폴더
results_horizontal	2025-12-20 오전 1:01	파일 폴더
results_radial_autocorr	2025-12-19 오후 4:40	파일 폴더
results_vertical	2025-12-16 오전 9:27	파일 폴더
sample	2025-12-22 오후 1:53	파일 폴더
analyze_horizontal_continuity	2025-12-15 오후 9:41	Python File
analyze_radial_autocorr_profile	2025-12-18 오후 9:47	Python File
analyze_vertical_vbridge	2025-12-13 오후 5:29	Python File
compare_autocorr_vs_QFlink	2025-12-18 오후 11:55	Python File
make_center_from_boundary	2025-12-12 오전 10:34	Python File
sphere_center_preview_manual	2025-12-22 오후 1:50	Microsoft Edge F
sphere_center_radius.npy	2025-12-22 오후 1:50	NPY 파일
tails_pattern	2025-12-11 오후 9:34	GOM 미디어 파일

Key elements:

- Python scripts (*.py)
- Input video file (tails_pattern.mov)
- Result directories:
 - results_horizontal/
 - results_vertical/
 - results_radial_autocorr/
 - results_compare/

3. Horizontal Spatial Continuity Analysis

3.1 Script Execution

The horizontal spatial continuity analysis is performed by executing:

analyze_horizontal_continuity.py

When executed, the script:

- loads the input video tails_pattern.mov,
- reads the sphere center and radius from sphere_center_radius.npy,
- initializes patch-based sampling along the horizontal (radial) direction.

Figure 2. Console output during execution of analyze_horizontal_continuity.py.

```
[14:16:28] START analyze_horizontal_continuity.py
[14:16:28] OUT_DIR = C:\tail_analysis\results_horizontal
[14:16:28] SIDE=left, R0=0.9cm, RMAX=3.9cm, PATCH=3x15px, GAP=1px
[14:16:28] BRIDGE_MODE=False, BRIDGE_R_CM_TARGET=1.2, BRIDGE_PATCH_INDEX_MANUAL=15
[START] out_base=C:\tail_analysis\results_horizontal\patch_20251222_141628
Video: C:\tail_analysis\tails_pattern.mov
FPS=29.970, Frames=624
Center: xc=2965.37, yc=1140.05, R_pix=713.89
num_patches=151, delta_r_cm_used=0.02, min_dx_px=4px
```

3.2 Generated Results

Upon completion, a new timestamped subdirectory is created inside:

results_horizontal/

This directory contains:

- horizontal continuity maps,
- run-length histograms,
- radial profiles of correlation strength and time lag,
- summary text files and NumPy data files.

Figure 3. Files generated in the results_horizontal directory after horizontal continuity analysis.

이름	수정한 날짜	유형	크기
continuity_QF_link	2025-12-22 오후 2:17	Microsoft Edge P...	11
continuity_sign_strip	2025-12-22 오후 2:17	Microsoft Edge P...	11
continuity_tauF_link	2025-12-22 오후 2:17	Microsoft Edge P...	11
p0_vs_pk_pack.npz	2025-12-22 오후 2:17	NPZ 파일	1
patch_geometry	2025-12-22 오후 2:17	Microsoft Edge P...	11
patch_r_cm.npy	2025-12-22 오후 2:17	NPY 파일	1
patch_x_px.npy	2025-12-22 오후 2:17	NPY 파일	1
patch_y_px.npy	2025-12-22 오후 2:17	NPY 파일	1
Q0_vs_r	2025-12-22 오후 2:17	Microsoft Edge P...	11
QF_link.npy	2025-12-22 오후 2:17	NPY 파일	1
QF_vs_r	2025-12-22 오후 2:17	Microsoft Edge P...	11
r_link.npy	2025-12-22 오후 2:17	NPY 파일	1
run_log	2025-12-22 오후 2:17	텍스트 문서	1
runlen_hist_all	2025-12-22 오후 2:17	Microsoft Edge P...	11
runlen_hist_split	2025-12-22 오후 2:17	Microsoft Edge P...	11
runlen_pack.npz	2025-12-22 오후 2:17	NPZ 파일	1
sign_link.npy	2025-12-22 오후 2:17	NPY 파일	1
summary	2025-12-22 오후 2:17	텍스트 문서	3
tau0_vs_r	2025-12-22 오후 2:17	Microsoft Edge P...	11
tauF_link.npy	2025-12-22 오후 2:17	NPY 파일	1
tauF_vs_r	2025-12-22 오후 2:17	Microsoft Edge P...	11
v_vs_r	2025-12-22 오후 2:17	Microsoft Edge P...	11

4. Vertical Synchronous (Bridge) Analysis

4.1 Script Execution

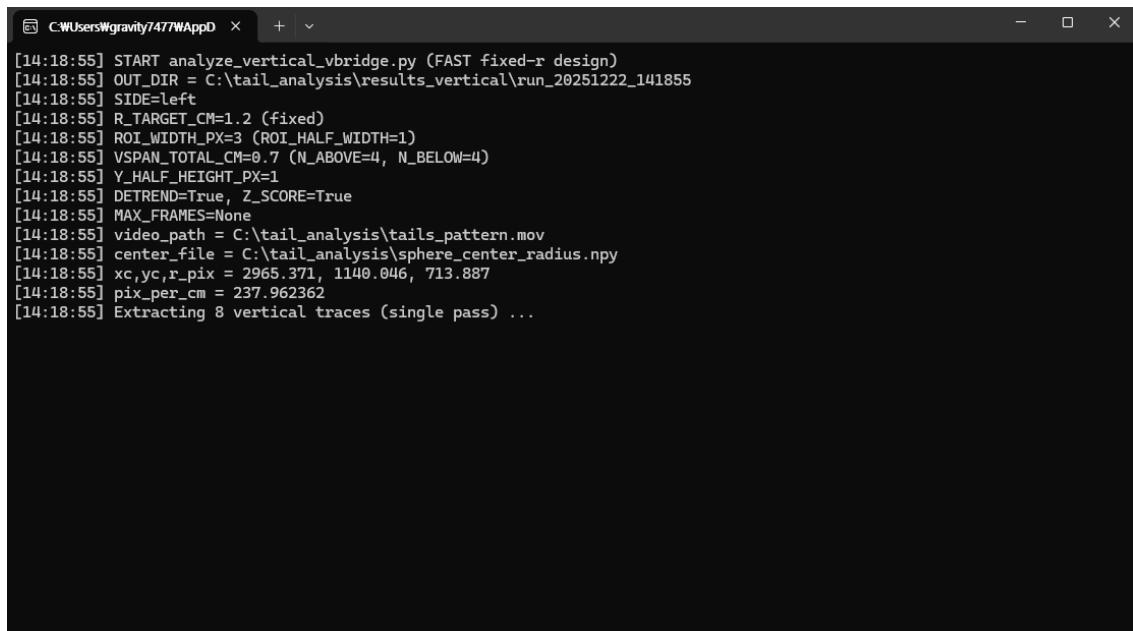
Vertical synchronous analysis at a fixed radial anchor is performed by executing:

```
analyze_vertical_vbridge.py
```

This script:

- uses a fixed radial position,
- extracts vertically separated intensity traces,
- computes zero-lag correlation matrices to assess temporal synchrony.

Figure 4. Console output during execution of `analyze_vertical_vbridge.py`.



```
[14:18:55] START analyze_vertical_vbridge.py (FAST fixed-r design)
[14:18:55] OUT_DIR = C:\tail_analysis\results_vertical\run_20251222_141855
[14:18:55] SIDE=left
[14:18:55] R_TARGET_CM=1.2 (fixed)
[14:18:55] ROI_WIDTH_PX=3 (ROI_HALF_WIDTH=1)
[14:18:55] VSPAN_TOTAL_CM=0.7 (N ABOVE=4, N BELOW=4)
[14:18:55] Y_HALF_HEIGHT_PX=1
[14:18:55] DETREND=True, Z_SCORE=True
[14:18:55] MAX_FRAMES=None
[14:18:55] video_path = C:\tail_analysis\tails_pattern.mov
[14:18:55] center_file = C:\tail_analysis\sphere_center_radius.npy
[14:18:55] xc,yc,r_pix = 2965.371, 1140.046, 713.887
[14:18:55] pix_per_cm = 237.962362
[14:18:55] Extracting 8 vertical traces (single pass) ...
```

4.2 Generated Results

The script generates a timestamped result directory inside:

results_vertical/

This directory includes:

- vertical correlation matrices,
- trace previews,
- synchrony visualization plots,
- associated NumPy and text files.

Figure 5. Files generated in the results_vertical directory after vertical synchrony analysis.

이름	수정한 날짜	유형	크기
corr_matrix_vbridge.npy	2025-12-22 오후 2:19	NPY 파일	
corr_matrix_vbridge	2025-12-22 오후 2:19	Microsoft Edge P...	2
corr_matrix_vbridge	2025-12-22 오후 2:19	알씨 PNG 파일	6!
run_info	2025-12-22 오후 2:19	텍스트 문서	
run_log	2025-12-22 오후 2:19	텍스트 문서	
traces_preview	2025-12-22 오후 2:19	Microsoft Edge P...	4!
traces_preview	2025-12-22 오후 2:19	알씨 PNG 파일	33!
traces_vbridge.npy	2025-12-22 오후 2:19	NPY 파일	4!

5. Radial Temporal Persistence Analysis

5.1 Script Execution

Radial temporal persistence is analyzed by executing:

analyze_radial_autocorr_profile.py

This script:

- samples intensity time series along the radial direction,
- computes temporal autocorrelation functions,

- evaluates time persistence as a function of radial distance.

Figure 6. Console output during execution of analyze_radial_autocorr_profile.py.

```
[14:22:00] Video: C:\tail_analysis\tails_pattern.mov
[14:22:00] Center: xc=2965.37, yc=1140.05, R_pix=713.89
[14:22:00] pix_per_cm = 237.9624 (R_pix / 3.0cm)
[14:22:01] Frame size: W=3840, H=2160
[14:22:01] Control ROI (fixed): x=50.0px, y=1140.0px, valid=True, roi=(49, 1130, 52, 1151)
[14:22:01] r[0]= 0.90cm -> x= 2037.3, y= 1140.0, valid=True
[14:22:01] r[1]= 1.30cm -> x= 1942.1, y= 1140.0, valid=True
[14:22:01] r[2]= 1.70cm -> x= 1846.9, y= 1140.0, valid=True
[14:22:01] r[3]= 2.10cm -> x= 1751.8, y= 1140.0, valid=True
[14:22:01] r[4]= 2.50cm -> x= 1656.6, y= 1140.0, valid=True
[14:22:01] r[5]= 2.90cm -> x= 1561.4, y= 1140.0, valid=True
[14:22:01] r[6]= 3.30cm -> x= 1466.2, y= 1140.0, valid=True
[14:22:01] r[7]= 3.70cm -> x= 1371.0, y= 1140.0, valid=True
[14:22:01] r[8]= 4.10cm -> x= 1275.8, y= 1140.0, valid=True
[14:22:01] r[9]= 4.50cm -> x= 1180.7, y= 1140.0, valid=True
[14:22:01] r[10]= 4.90cm -> x= 1085.5, y= 1140.0, valid=True
[14:22:01] r[11]= 5.30cm -> x= 990.3, y= 1140.0, valid=True
[14:22:01] r[12]= 5.70cm -> x= 895.1, y= 1140.0, valid=True
[14:22:01] r[13]= 6.10cm -> x= 799.9, y= 1140.0, valid=True
[14:22:01] r[14]= 6.50cm -> x= 704.7, y= 1140.0, valid=True
```

5.2 Generated Results

The outputs are written to a timestamped directory inside:

results_radial_autocorr /

Generated files include:

- autocorrelation curves,
- radial autocorrelation maps,
- persistence metrics,
- summary logs and data tables.

Figure 7. Files generated in the results_radial_autocorr directory after radial autocorrelation analysis.

이름	수정한 날짜	유형	크기
PDF autocorr_curves	2025-12-22 오후 2:22	Microsoft Edge P...	14
PNG autocorr_curves	2025-12-22 오후 2:22	알씨 PNG 파일	7
PDF autocorr_map	2025-12-22 오후 2:22	Microsoft Edge P...	20
PNG autocorr_map	2025-12-22 오후 2:22	알씨 PNG 파일	3
XLS radial_profile	2025-12-22 오후 2:22	Microsoft Excel ...	1
DOC run_log	2025-12-22 오후 2:22	텍스트 문서	1
PDF S_vs_r	2025-12-22 오후 2:22	Microsoft Edge P...	14
PNG S_vs_r	2025-12-22 오후 2:22	알씨 PNG 파일	6

6. Comparative Analysis: Continuity vs Temporal Persistence

6.1 Script Execution

A final comparative analysis is performed using:

compare_autocorr_vs_QFLink.py

This script:

- automatically selects the **most recent** result directory from results_horizontal/ ,
- automatically selects the **most recent** result directory from results_radial_autocorr/ ,
- compares spatial continuity metrics with temporal persistence metrics.

Figure 8. Console output during execution of compare_autocorr_vs_QFlink.py.

```
C:\tail_analysis>py compare_autocorr_vs_QFlink.py
=====
COMPARE DONE
AUTOCORR: ./results_radial_autocorr\run_20251222_142200
CONT     : ./results_horizontal\patch_20251222_141628
OUT      : ./results_compare\run_20251222_144000
Metric   : QF AGG: median
Pearson  : 0.8789470526697702 Spearman: 0.9047619047619048
Pearson CI : (0.6260482865955996, 0.9911343705866561)
Spearman CI: (0.3924050632911392, 1.0)
=====
```

6.2 Generated Results

Comparison results are stored in:

results_compare/

These files quantify:

- the correspondence between spatial continuity and temporal persistence,
- agreement between horizontal correlation structure and radial memory effects,
- summary plots and comparison statistics.

Figure 9. Files generated in the results_compare directory after comparative analysis.

이름	수정한 날짜	유형	크기
PDF overlay	2025-12-22 오후 2:24	Microsoft Edge P...	1
PNG overlay	2025-12-22 오후 2:24	알씨 PNG 파일	10
PDF scatter	2025-12-22 오후 2:24	Microsoft Edge P...	1
PNG scatter	2025-12-22 오후 2:24	알씨 PNG 파일	3
summary	2025-12-22 오후 2:24	텍스트 문서	

7. Summary of the Analysis Flow

The complete analysis pipeline proceeds as follows:

1. Execute `make_center_from_boundary.py` → define sphere geometry
2. Execute `analyze_horizontal_continuity.py` → spatial continuity
3. Execute `analyze_vertical_vbridge.py` → vertical temporal synchrony
4. Execute `analyze_radial_autocorr_profile.py` → temporal persistence
5. Execute `compare_autocorr_vs_QFLink.py` → continuity-persistence comparison

Each script produces outputs in a **dedicated result directory**, ensuring traceability and reproducibility.