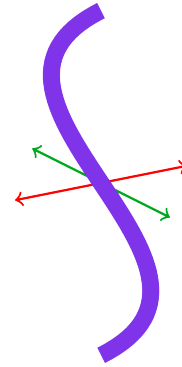


Documentation

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SCOLIOMORPH

ToolKit



Scoliomorph: A Spatial Orientation Analysis Library for Vertebral Body Point Cloud

This library provides tools to load [STL](#) files, compute pitch, roll, and yaw angles based on the principal axes, and visualize the results.

Method

See the [Method Description](#) with figures.

Installation

Option 1: Install Directly from GitHub

You can install Scoliomorph directly from the GitHub repository using `pip`:

```
pip install git+https://github.com/raviumadi/scoliomorph.git
```

Option 2 - Git clone and Install

1. Clone the Repository

```
git clone git@github.com:raviumadi/scoliomorph.git
cd scoliomorph/
pip install -e .
```

2. Setup a virtual environment (optional but recommended)

If you don't already have a virtual environment set up:

```
# Create virtual environment
python3 -m venv .venv

# Activate virtual environment
source .venv/bin/activate # On Linux/macOS
# .\.venv\Scripts\activate # On Windows
```

3. Install the package

```
pip install -e .
```

Usage

1. Load STL Files and Perform Analysis

You can use the scoliomorph package to load STL files, calculate pitch, roll, and yaw, and plot the results. Here's an example:

```
from scoliomorph.analysis import load_stl_file, calculate_principal_axes, plot_2d_angles_with_labels
import os

# Path to the STL file (assumes 'stl' directory is at the same level as your script)
stl_file_path = os.path.join(os.path.dirname(__file__), '..', 'stl', 'example.stl')

# Load the STL file
points = load_stl_file(stl_file_path)

# Calculate pitch, roll, and yaw
pitch, roll, yaw, centroid, centered_points, principal_axes = calculate_principal_axes(points)

# Plot the results
plot_2d_angles_with_labels(pitch, roll, yaw, principal_axes, centered_points)
```

2. Running Examples

There are example scripts provided in the examples/ folder. To run them, follow these steps:

```
cd examples
python example_X.py
```

Library Functions

- `load_stl_file()`
 - Load STL file and extract the points from the mesh.
 - `calculate_principal_axes()`
 - Calculate pitch, roll, yaw based on the principal axes of the point cloud.
 - `calculate_vbc_profile()`
 - Calculate the vertebral column geometric properties for each STL file in the folder.
 - `plot_2d_angles_with_labels()`
 - Plot the pitch, roll, yaw along with the point cloud projections.
 - `plot_point_cloud_fixed_axes()`
 - Plot the point cloud with fixed global coordinate system and angular lines.
 - `plot_stl_files()`
 - Function to load STL files from a folder, align points to $(x, y) = (0, 0)$, and plot them.
- Parameters:**
- * `folder_path` : str
 - Path to the folder containing STL files.
 - * `plot_type` : str
 - Type of plot ('pointcloud' or 'mesh'). Default is 'pointcloud'.
 - * `color` : str
 - Color for the plot (e.g., 'red', 'blue'). Default is 'blue'.
 - * `alpha` : float
 - Transparency level for the plot (0.0 to 1.0). Default is 1.0 (opaque).
- `plot_vbc_profile()`
 - Plot the point cloud centroids of the vertebral column units with pitch, roll, and yaw vectors

- `normalize_angles()`
 - Normalize pitch, roll, and yaw to stay within the range $[-90^\circ, +90^\circ]$ by converting them to their complementary angles if they exceed 90° or -90° .
- `set_axes_equal()`
 - Set 3D plot axes to equal scale.
- `normalize_angle()`
 - Normalize an individual angle to stay within $[-90^\circ, 90^\circ]$.

Cite as

If you use this project in your research, please cite it as follows:

```
@misc{umadi2024project,
  author = {Ravi Umadi},
  title = {Scoliomorph: A Spatial Orientation Analysis Library for Vertebral Body Point Cloud},
  year = {2024},
  publisher = {GitHub},
  journal = {GitHub repository},
  howpublished = {\url{https://github.com/raviumadi/scoliomorph}},
  version = {1.0}
  note = {Klinikum rechts der Isar, TUM School of Medicine, Klinik für Orthopädie und Sportorthopädie,
    Ismaninger Str. 22, 81675 München}
}
```

Contributing

If you'd like to contribute, feel free to open issues or submit pull requests.

License

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Bibliography

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