

MACHINE LEARNING ANNOTATION TOOL

User Manual



Capstone Project 5703

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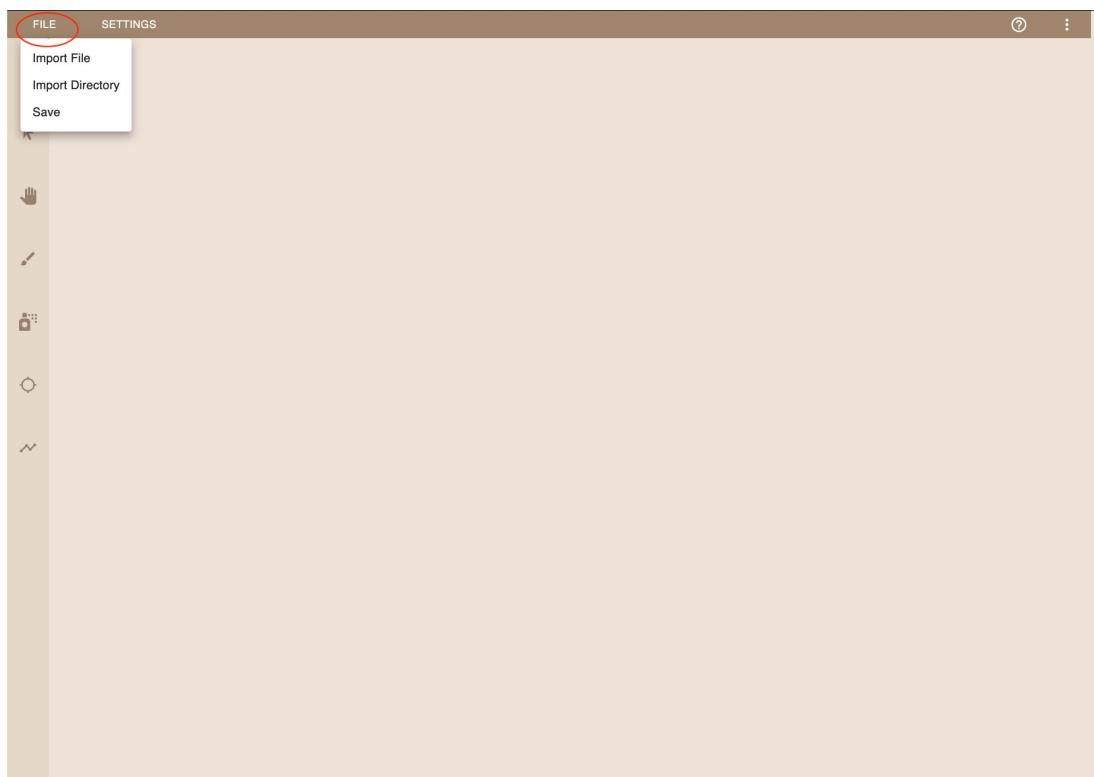
1. Introduction

This tool is designed to provide efficient and accurate 3D model annotation, specifically tailored for dental applications. It allows dental professionals and researchers to annotate 3D structures with precision, streamlining the annotation process for better data analysis and machine learning applications.

2. Using the ML Annotation Tool

2.1 File Import

Importing STL Files or Folders



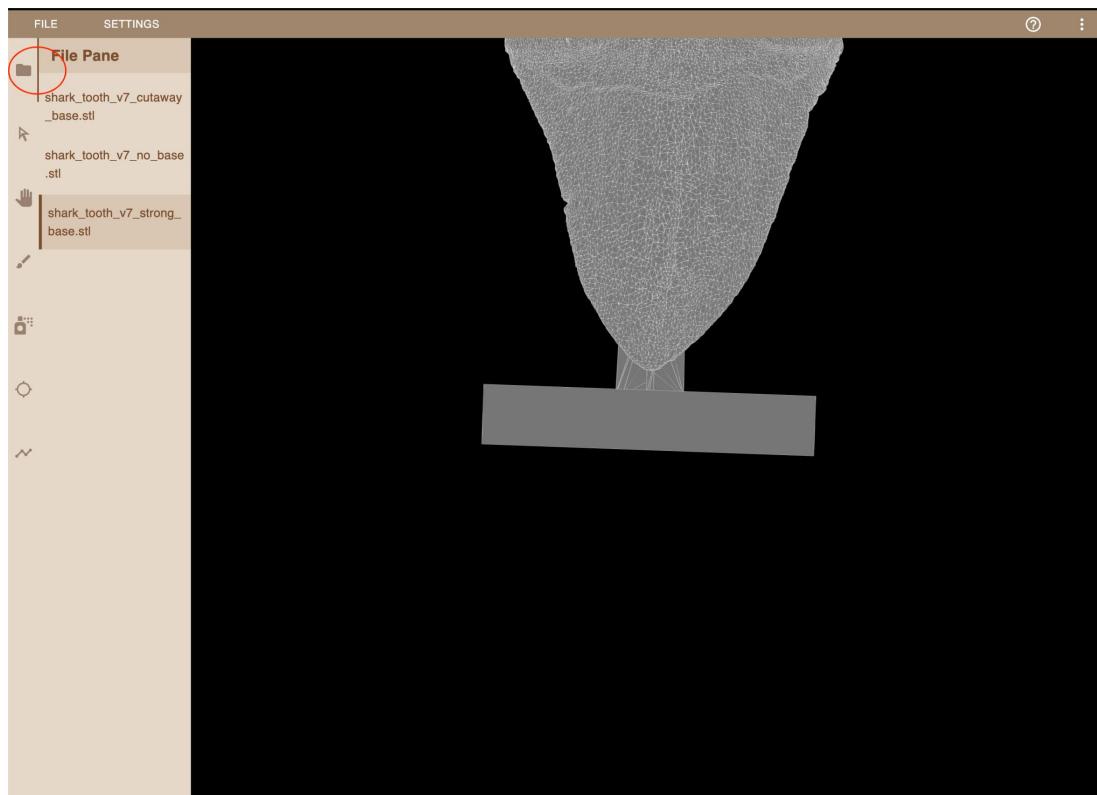
In the menu bar, go to the **File** menu to view import options. You can:

- **Import File:** This option allows users to import one or more STL files. It is ideal for annotating single or multiple 3D models. After selecting this option, you can choose one or more STL files from the file browser to import.
- **Import Directory:** This option lets you import a folder containing multiple STL files and associated annotation information in JSON format. The folder can include several STL model files and corresponding JSON files with annotation data. This feature is useful for batch processing multiple 3D models and their annotations.

Steps:

- Click on **File** in the menu bar and select either **Import File** or **Import Directory**.
- Browse and select the file(s) or folder you wish to import. The system will load the selected content and display all available files in the file panel.

2.2 File Panel Overview

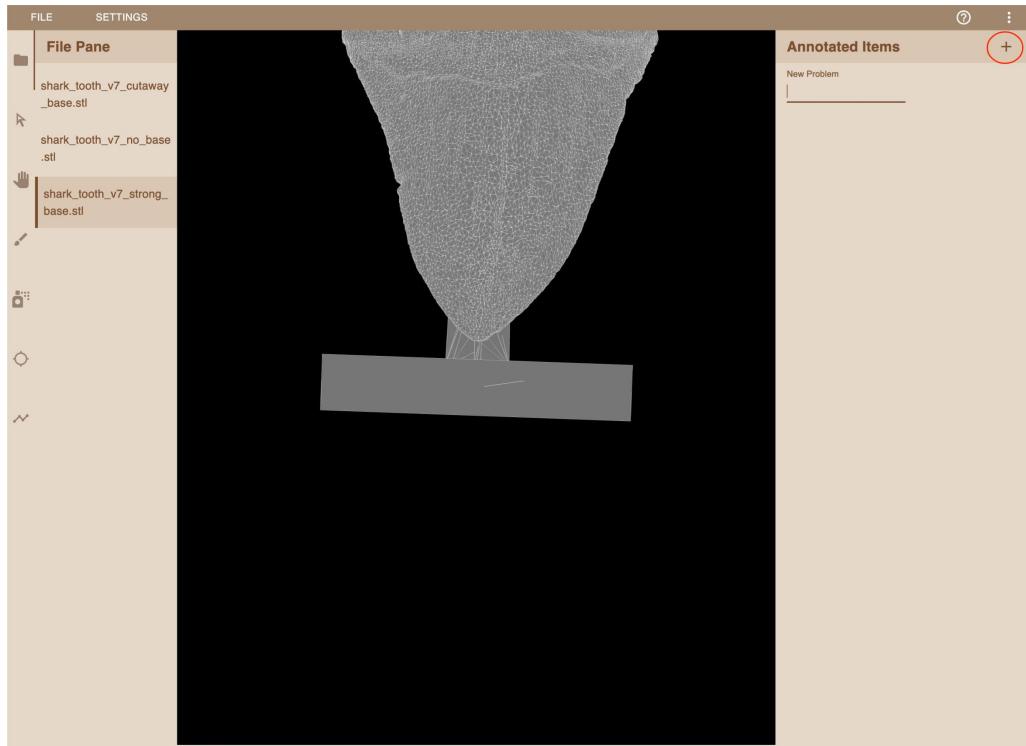


Once files are loaded, they will appear in the **File Panel** on the left side of the screen. Each file in the folder is listed, allowing users to select and annotate specific models.

2.3 Creating Problems and Classes



Click the three-dot menu next to the "Problem" label (highlighted in red in the screenshot) to open the Annotated Items panel.



In the **Annotated Items** panel:

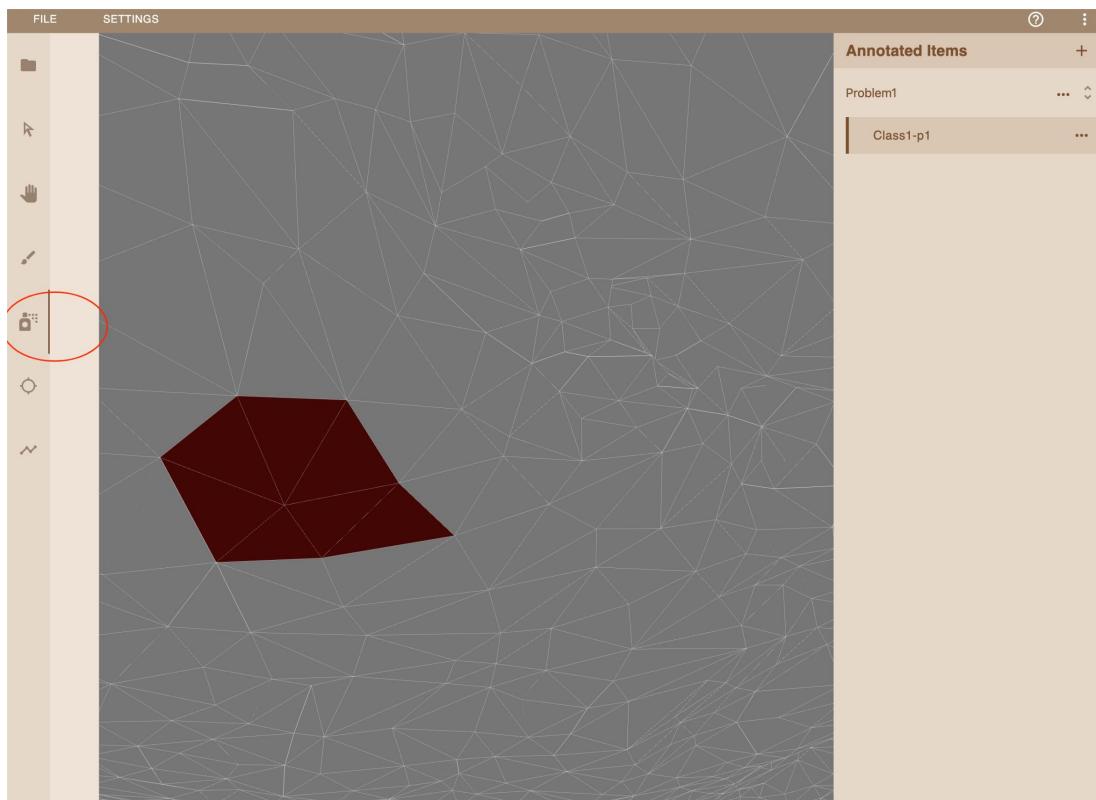
(1) Click on the "+" icon to create a new annotation "Problem." Each "Problem" represents a distinct annotation task or group, allowing for better organization of annotations.

(2) Under each created "Problem," you can add multiple classes by clicking the three-dot menu next to the "Problem" label. This menu provides options to:

- **Add** a new class under the selected problem to categorize different annotation types.
- **Edit** an existing class to update its label or description as needed.
- **Delete** a class if it is no longer needed for the annotation process.

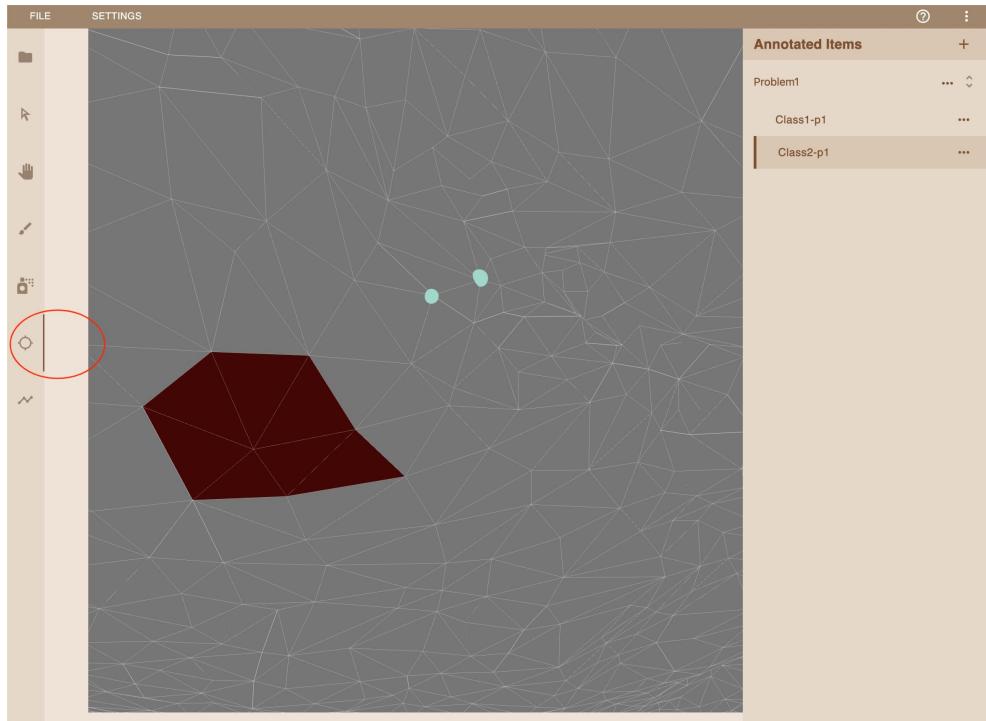
Each class within a problem allows you to define specific attributes or sections of the 3D model for structured and organized annotation.

2.4 Annotation Tools



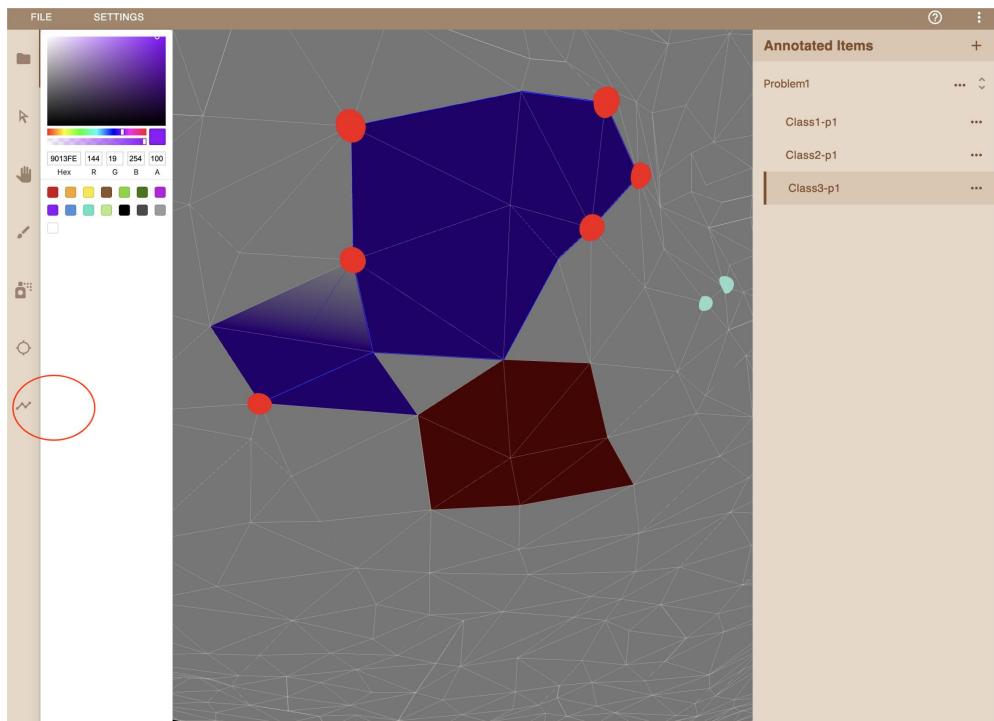
1. Spray Annotation

- **Purpose:** Ideal for annotating broader regions of the model with minimal effort.
- **How It Works:** Select the Spray tool from the toolbar. Drag the cursor over the model's surface, and the annotation is applied as if spraying paint on the area. This method is particularly effective for quickly marking large or uneven surfaces.



2. KeyPoint Annotation

- **Purpose:** Suited for precise marking of specific points or vertices on the model.
- **How It Works:** Use the KeyPoint tool to click on the exact locations you wish to annotate. The selected points are marked as key references for further analysis or classification.



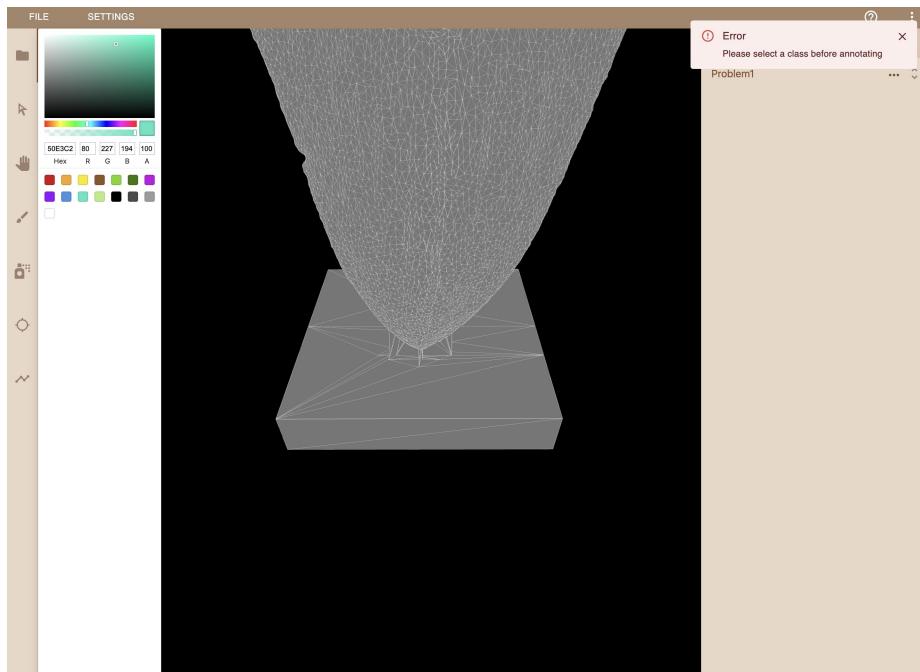
3. Shortest Path Annotation

- **Purpose:** Designed for creating precise boundary outlines by calculating the shortest path between two selected points on the model.
- **How It Works:**
 1. Select the Shortest Path tool from the toolbar.
 2. Choose a starting and ending point on the model's surface.
 3. The system automatically computes the shortest path connecting the two points, adhering to the model's geometric contours.

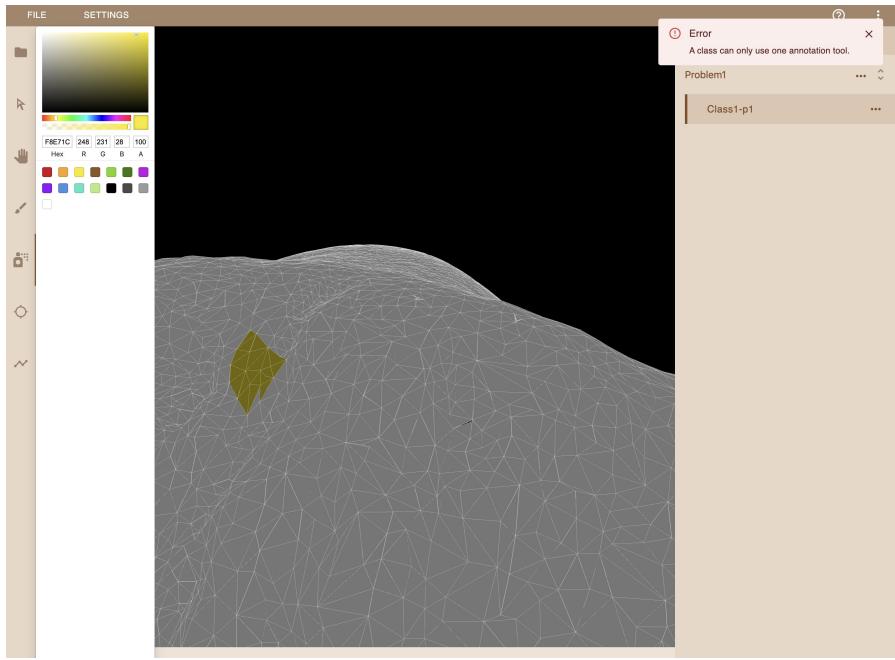
Additional Features:

- **Color Selection for Tools:** Users can assign distinct colors to different annotation tools to visually differentiate classes and annotations effectively.

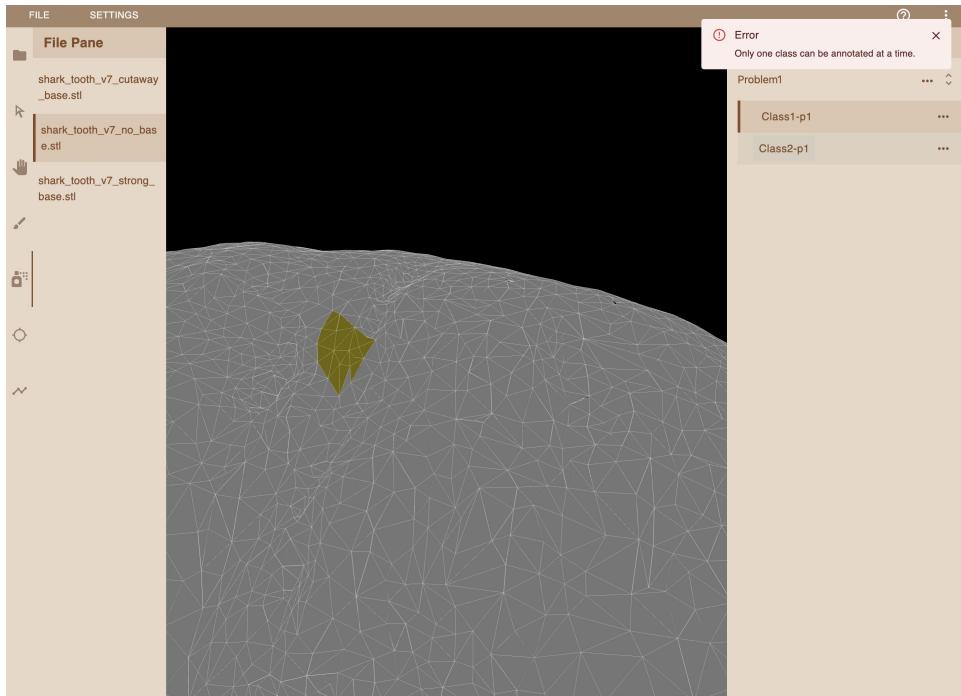
2.5 Annotation Tool Usage Warnings



(1) **Class Selection Required:** Before annotating, ensure that a class is selected. If you attempt to annotate without selecting a class, the system will display an error message: "Please select a class before annotating."

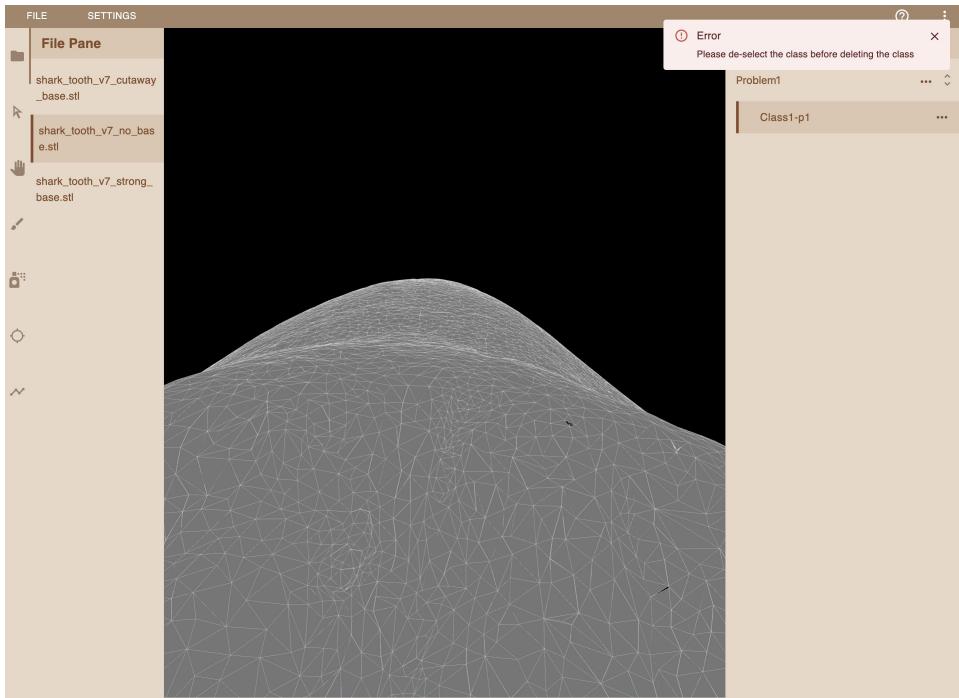


(2) Single Tool per Class: Each class can only utilize one annotation tool at a time. If you attempt to apply multiple tools on the same class, the system will show an error message: "A class can only use one annotation tool." Make sure to continue with the chosen tool to complete annotations for that specific class.

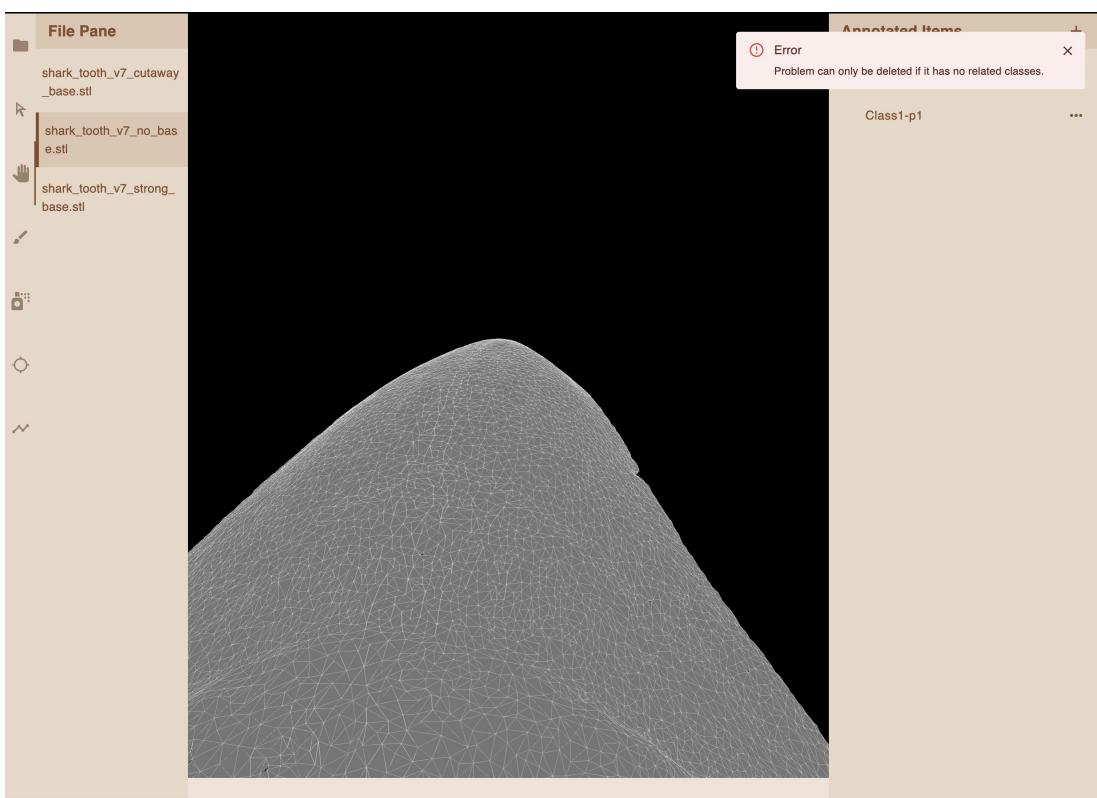


(3) Only One Class Can Be Annotated at a Time: When performing annotation operations, only one class can be annotated at a time. If you attempt to annotate multiple classes simultaneously, the system will display an error message: "*Only one*

class can be annotated at a time." Make sure to select the correct class before annotating to avoid conflicts.

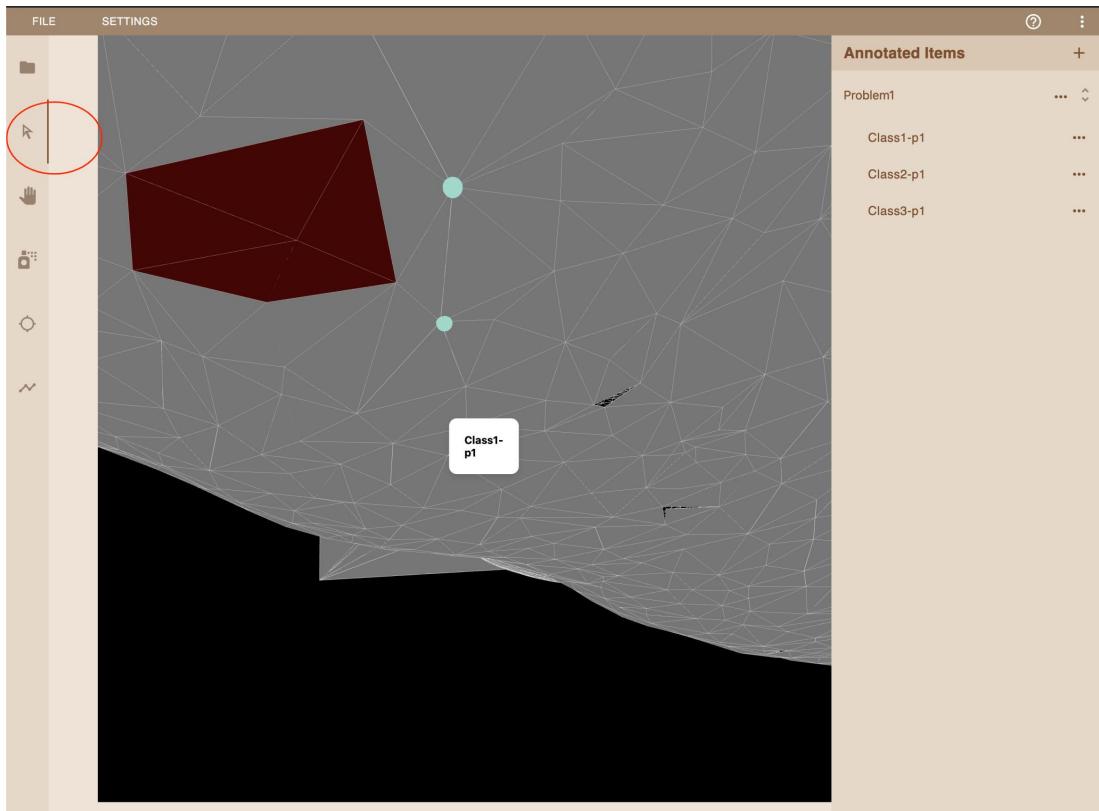


- (4) **Class Selection Requirement for Deletion:** Before deleting a class, make sure it is de-selected. If you attempt to delete a selected class, the system will display an error message: "*Please de-select the class before deleting the class.*" Ensure the class is not active in the selection to proceed with deletion.



(5) Problem Deletion Condition: A problem can only be deleted if it has no related classes. If you attempt to delete a problem that still contains classes, the system will display an error message: "*Problem can only be deleted if it has no related classes.*" Make sure to remove all classes under the problem before proceeding with its deletion.

2.6 Display Class for Annotated Regions

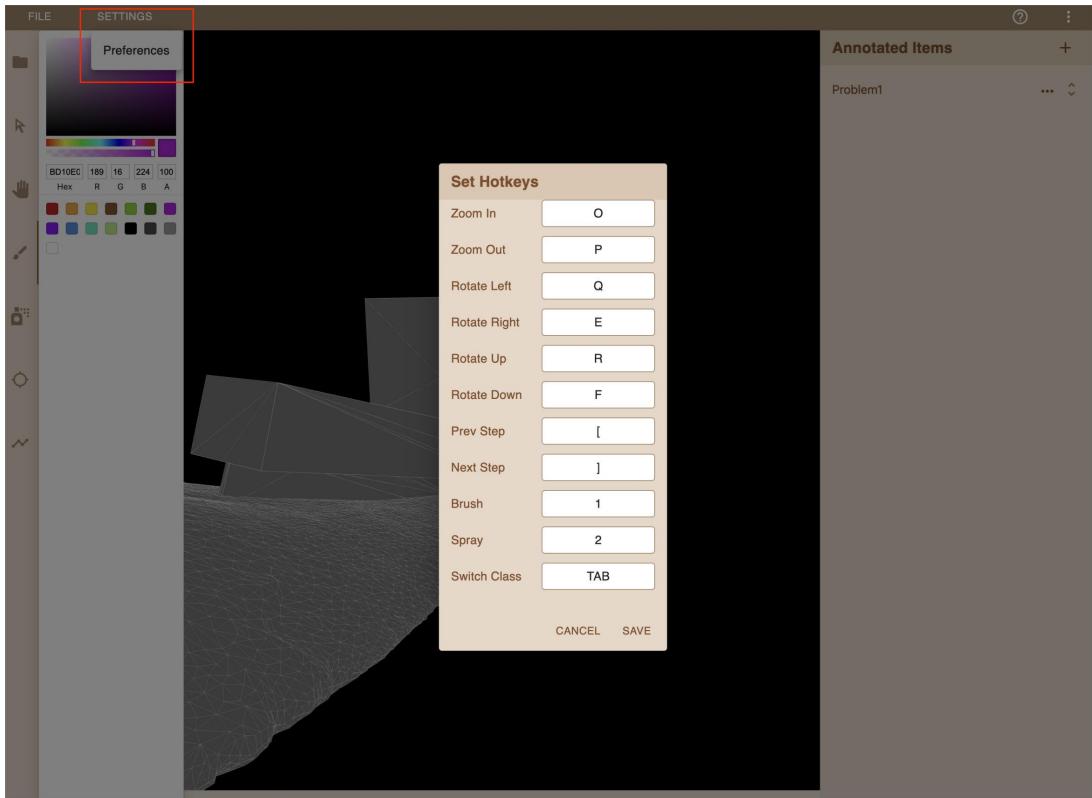


This feature allows users to view the class of a previously annotated region on the 3D model. By clicking on an annotated area, users can quickly identify the associated class, which will be displayed as a label.

How to Use:

1. Select the **Arrow tool** (highlighted in the red circle in the image above).
2. Click on any annotated area within the 3D model that has already been assigned a class.
3. The system will display the class label for the selected region, providing quick reference for users to confirm the class of each annotated section.

2.7 Hotkey Configuration



Under **Settings > Preferences**:

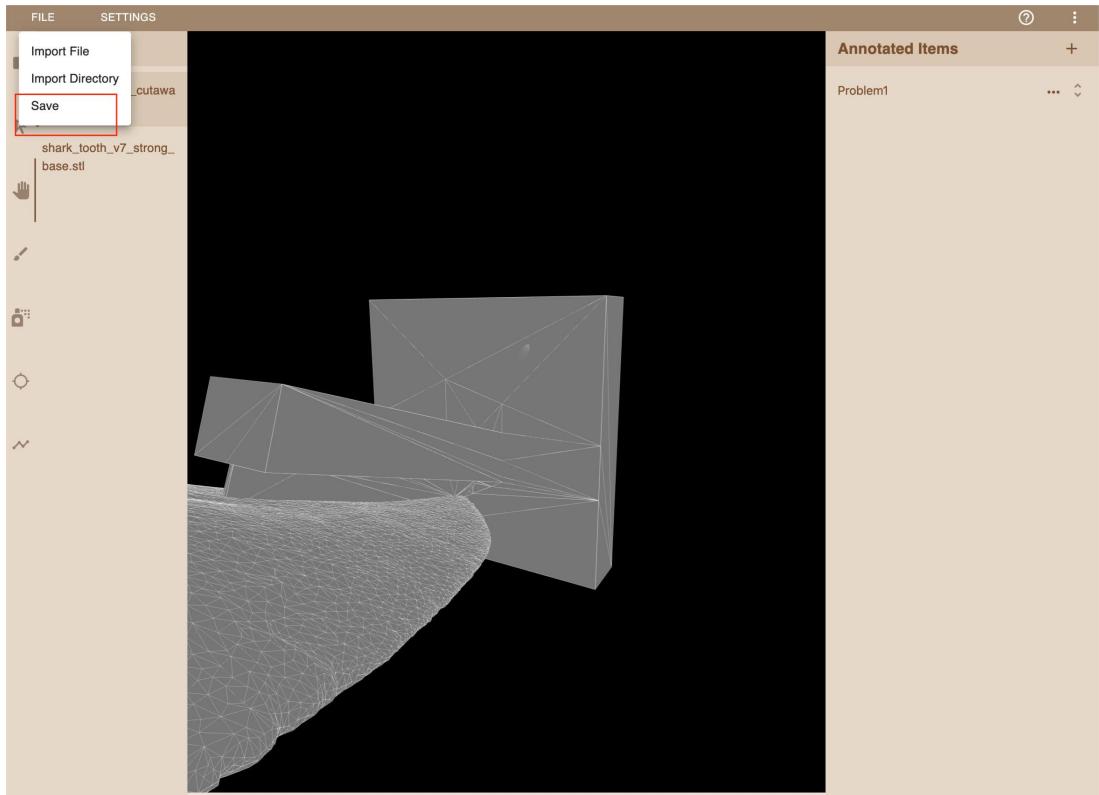
In the **Preferences** section, users can customize hotkeys for various functions to suit their workflow. Each function has a default hotkey, but users can modify these according to their preferences.

Here's how to customize hotkeys for each function:

1. **Zoom In**: Set your preferred hotkey for zooming into the model.
2. **Zoom Out**: Assign a hotkey to zoom out and see more of the model.
3. **Rotate Left**: Choose a key for rotating the model to the left.
4. **Rotate Right**: Assign a key for rotating the model to the right.
5. **Rotate Up**: Set a key for rotating the model upwards.
6. **Rotate Down**: Select a key for rotating the model downwards.
7. **Previous Step**: Define a hotkey to move back one step in the annotation process.
8. **Next Step**: Set a hotkey to move forward in the annotation sequence.
9. **Brush Tool**: Choose a key for activating the brush tool for annotation.
10. **Spray Tool**: Assign a key to activate the spray tool for annotation.
11. **Switch Class**: Define a hotkey for switching between different classes in the annotation panel.

After adjusting the hotkeys to your preferences, click **Save** to apply the changes. This flexibility allows you to create a setup that best fits your workflow and improves efficiency in annotation tasks.

2.8 Model Navigation and Saving Annotations



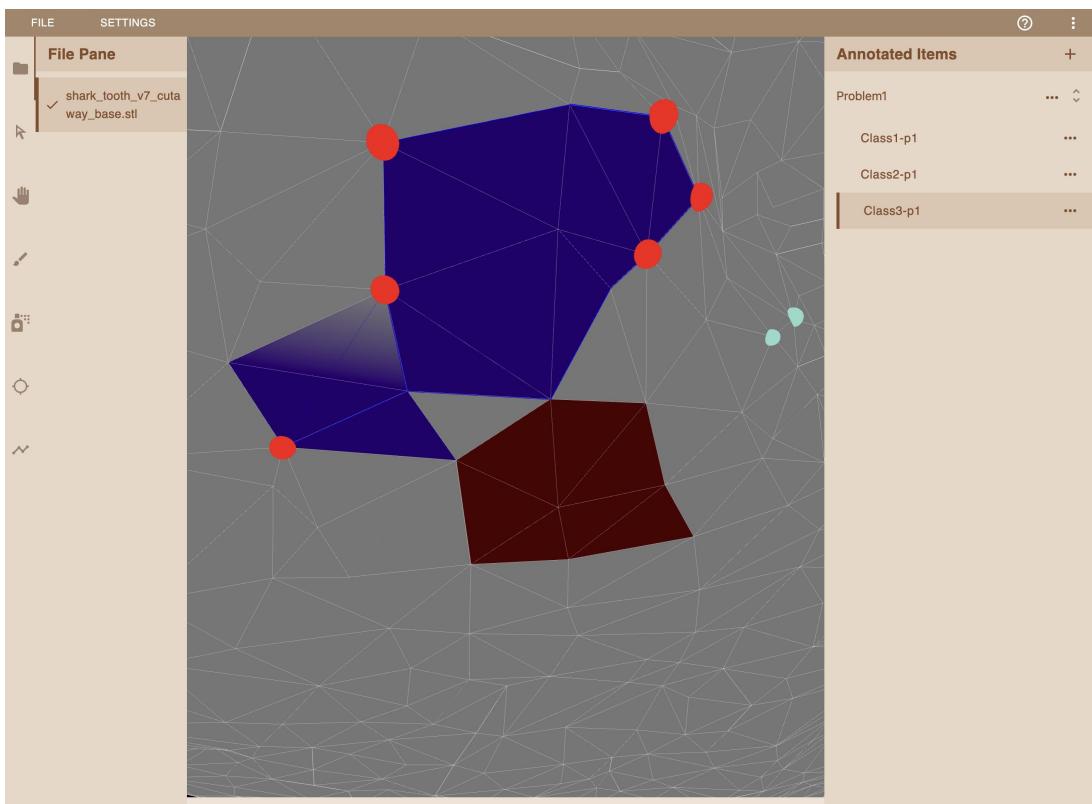
(1) Going Back to Previous Model:

- Users can navigate between different models within the **File** Pane on the left. By selecting a previously loaded model, any work done (e.g., annotations or paths) is saved, allowing users to continue from where they left off.
- This feature is beneficial when users need to switch between models for comparison or additional annotations without losing their work.

(2) Generating JSON File from Model:

- To save all annotations, classifications, and paths in a structured format, users can generate a JSON file.
- Go to the **File** menu, and select **Save**. This action will create a JSON file for the active STL model, preserving all annotation data.
- This file can later be reloaded, enabling continued work or review of saved annotations.

2.9 Opening Annotated Files from a Folder



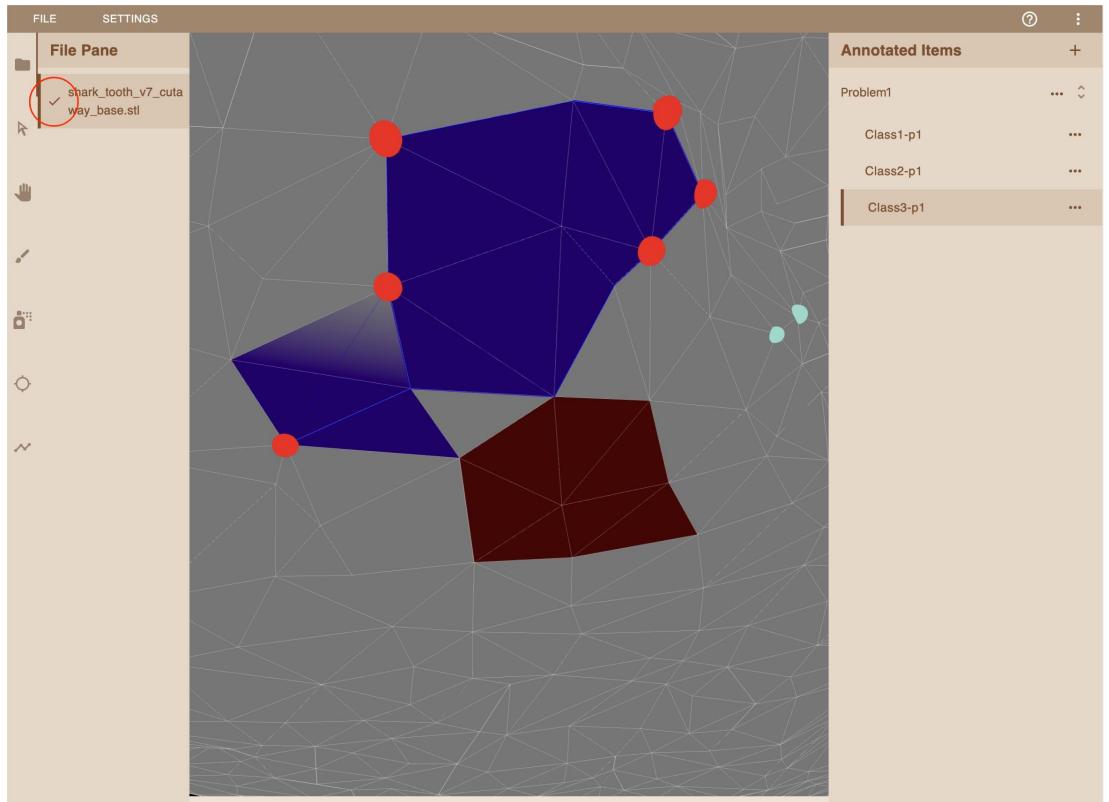
Opening an STL Folder with Annotated Files:

1. To load a folder containing multiple annotated files (STL and corresponding JSON files), use the **Import Directory** option under the **File** menu.
2. This is ideal for batch processing, where users can load multiple annotated models simultaneously, streamlining the workflow.

Annotation Data from JSON for Specific Models:

1. When opening models with existing JSON annotations, the system automatically reads and applies the annotation data.
2. Users can see annotations such as the shortest path or labels from the JSON file associated with each model in the **Annotated Items** panel.

2.10 Identifying Linked JSON Files



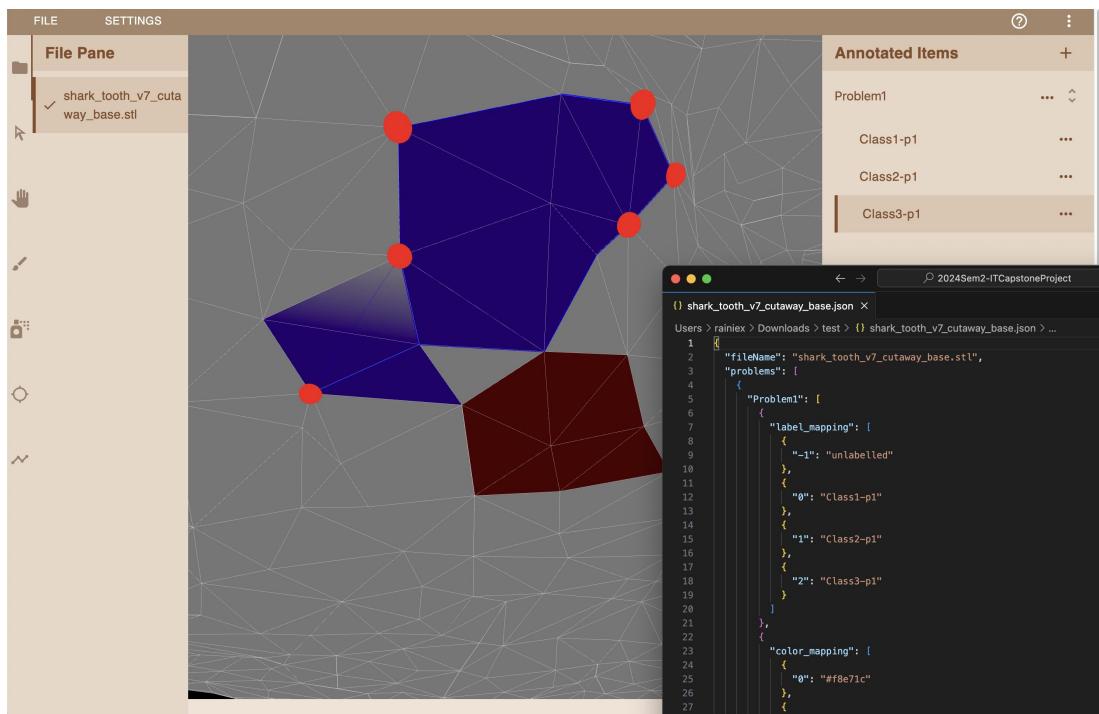
Indicating Models Linked to JSON Files:

1. Models linked to JSON files in the **File Pane** are marked with a check icon.
2. This mark helps users quickly identify which models have associated annotation data, simplifying model management.

Local Save for Unlinked Files:

1. Files without associated JSON files are saved locally on the user's machine.
2. This allows users to start annotations on models without prior annotation data and save their work locally if needed.

2.11 Viewing and Editing JSON Files



Viewing JSON Structure:

1. Users can open the folder containing JSON files directly to view and edit them if necessary.
2. The JSON structure includes details like filename, problems, label mappings, color mappings, and face labels, which define the annotations on each model.