Challenge Interview: Mesh similarity visualizer

Project Description / Requirements

- **General**: Complete a visualization tool in C++, that compares the similarity of 2 models, to help prepare yourself for the interview. This is an example of a feature you would create as a Graphics Software engineer. You will be quizzed on the project and its related topics during the scheduled interview.

  The sample project contains an un-optimized version of the tool. To optimize the tool you will be required to implement a spatial partitioning data structure. Beyond the standard implementation of a spatial partitioning data structure, your will need to further implement the following optimizations, in order to achieve interactive frame-rates.
  - Implement the data-structure in such a way that it exploits cache coherence
  - Minimize the number of times that the data structure is rebuilt when the scene changes.
  - Optimize the mathematical operations to reduce the cost of collision detection.

- **A description of the sample tool:**
  For each vertex of the first model cast rays along it's vertex normals. Based on the distance from the vertex of the first model to the closest surface of the second model color the vertex accordingly.
  - If the vertex lies on the surface of the second model color it as green [0, 255, 0]
  - In the forward direction of the vertex normal is the surface of the second model is further away than 0.5 cm, color the vertex blue [0,0,255]
  - In the reverse direction of the vertex normal if the surface of the second model lies further away than 0.5cm, color the vertex red [255,0,0]
  - For all other intervening values, color the vertex appropriately, using a linear mapping of color to the distance away from the vertex of the first model.
  - Provide fast resolution of collision queries, even after the models have been rotated and translated.
  - Expect model with a vertex density of about 20,000 vertices.

- **Preparing for the interview:** As a graphics software engineer you will be writing custom 3d Visualization tools from scratch using OpenGL 3.0 and C++. As such we will be quizzing you on the following topics:

    - **Model Transforms and 3D spaces:**
      To Allow the user to view and manipulate the 3D models in3D space, understanding how to manipulate models and a strong grasp of the 3D spaces is essential

    - **Collision detection algorithms:**
      Collision detection is essential to better understand the meshes we manipulate and derive business value

    - **Rendering:**
      Rendering concepts such as surface shading, perspective transforms and the Shader pipeline, and cameras

    - **Optimisation:**
        - Graphics related algorithms
        - Mathematical optimizations for geometric operations
        - Cache coherent implementation of data structures.

    - **C++ features and debugging:**
      The team primary codes in C++, fluency in the language will be an important factor that will affect your productivity on the job.

Project Communication:

- For all challenge interview communications, please kindly contact kevint@netvirta.com

- Your assigned challenge project reviewer will receive your feedback & questions via the above email channel and communicate with you accordingly.