Large-scale scene simulation of games in cold-temperate deciduous coniferous forest area based on UE

Zhiyuan Wang

QM No.190017767

1. The Purpose of the Project

Problem Definition

1. Create a simulation of a frigid zone surface landscape

2. Highlight the characteristics of the area - flora, climate and topography

3. Done using PCG algorithm

4. Done with Unreal Engine

Objectives

1. Obtain detailed terrain data to simulate real terrain as closely as possible.

2. Obtain survey data and build a vegetation cluster model.

3. Complete the PCG algorithm and add procedural plant assets.

4. Build the cold temperate 3D game scenes with UE5, including lighting, rendering, shooting and particle effects.

北京邮电大学 Queen Mary University of London
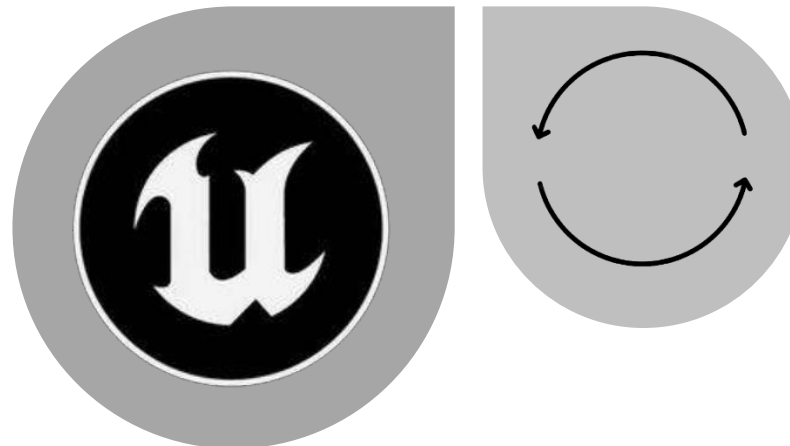
2. Background

Cold Zone

- Greater Khingan Range
- Snow Effect

Unreal Engine 5

- Material Function
- Procedural Content Generation
- Weather Function

Vegetation Cover

- Forest: Broad-leaved forest
      Coniferous forest
- Shrub and Grassland

Procedural Content Generation

- Tree Generation: PFS
- Shrub Generation: LGT

3. Finished work to date

1 Vegetation Model

Vegetation: trees and other plants

Trees： Birch, Larch, Black Alder, Spruce

Grass Land: Pine bushes, Big oil awn, Daisy…

Tree Generation: Procedural Foliage Spawner **-PFS**

Shrub Generation: Landscape Grass Type **- LGT.**

2 Material Function

Planar: generating grass on flat land

Slope: generating cobblestones on gentle slopes

Side: generating the cliff on steep slopes

Foliage Eraser: eliminating grass generated by LGT

Caustics: giving the rain erosion effect to the auto layer

Auto: mixes all the above layers and sets several parameters to adjust the automatic generation effect

3 Snow Effect

Snow function: controls parameters such as the snowfall curve

Subfunction: needs to be linked to the output node of each material to controlling the color

2D blend: Use WorldAlignedBlend method to blend the white color directly to the surface of the material to create the snow effect.

4 Scene Optimization

Set mesh LOD (Levels of Detail)

Set the position and importance of the nodes of the plant asset, determine the resource allocation for object rendering
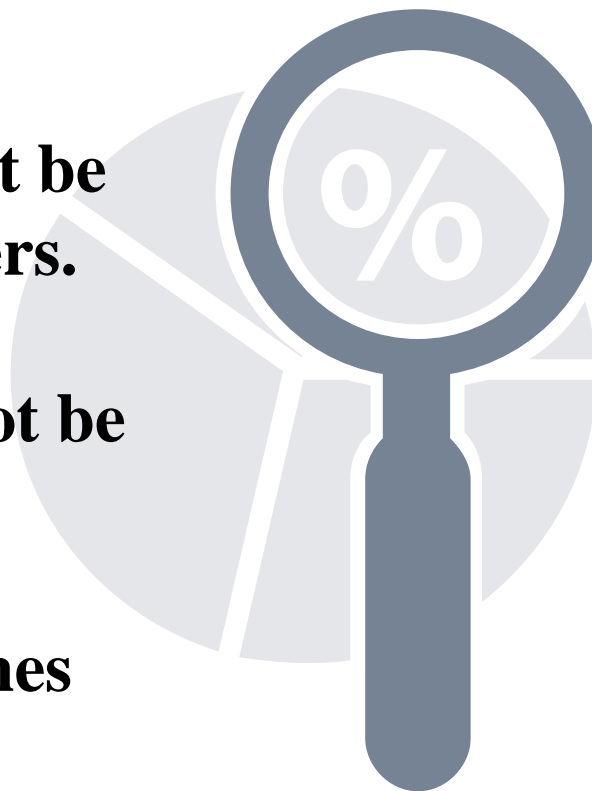
Set the mesh culling distance (Cull Distance)

By setting Cull Distance, mesh components are automatically culled from the scene after a certain distance from the camera, saving computational performance.

4. Problems and Solutions

Problems——

- **The snow material cannot be added to all material layers.**

- **Scene sound effects cannot be added correctly.**

- **The scene FPS is sometimes lower than 30.**

——Solutions

- Modify the material blending function so that the snow effect can be added to the material layer.

- Create sound effects then add sound effects.

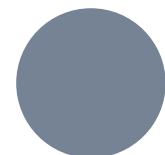- Scene performance optimization: set mesh LOD, set mesh Cull Distance.

5. Further Work
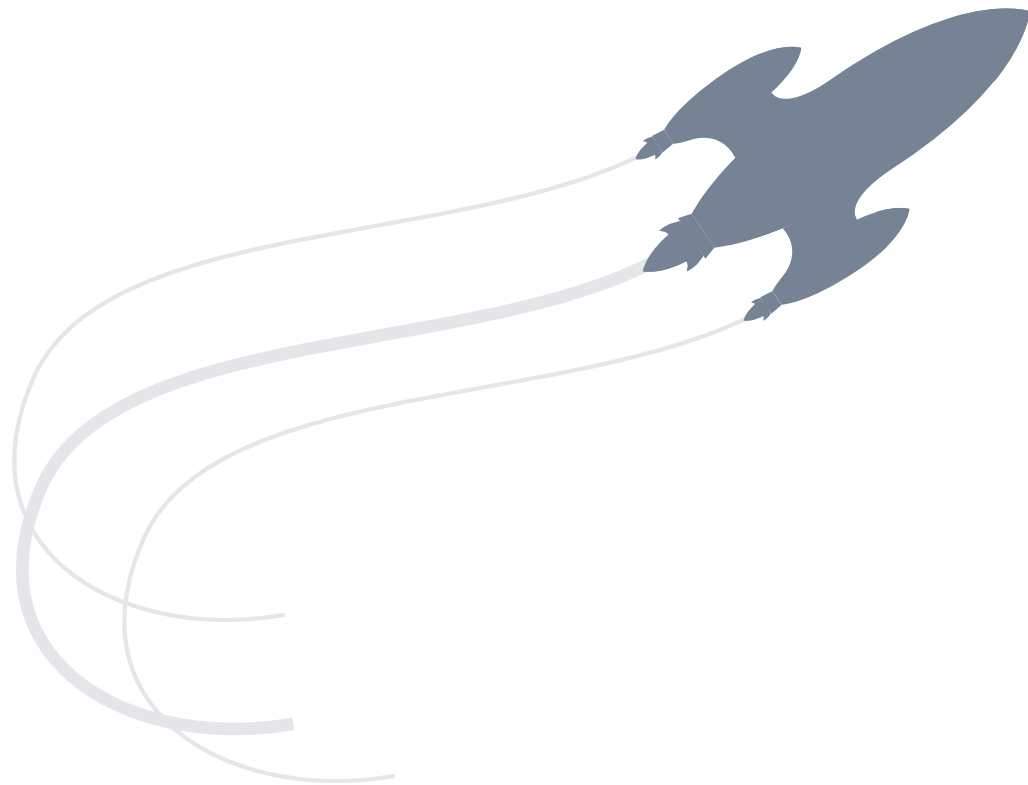
Works:

1. Improve scene performance optimization.
   - LOD
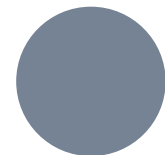   - Cull Distance
   - Virtual Texture

2. It is expected to add two scene highlights:

Snow effect - **Interactive snow**

- Snow effect: plants, leaves, ground
- Movement leaves traces on snow.

Seasonal effect – **Seasonal leaf color**

- The leaves change color with the seasons
- Seasonal system
- "Colorful mountain"

北京邮电大学 Queen Mary University of London