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## AI-Assisted 2D to 3D Level Generation in Unreal Engine 5

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Abstract: Modern level design in game development demands considerable time and effort, especially when translating concept art or reference images into 3D environments. While Unreal Engine 5 provides tools for procedural generation, it lacks the ability to semantically interpret visual content, often leading to unsuitable asset placement. This research proposes an AI-enhanced framework to automate the conversion of 2D images into corresponding 3D environments. The process initiates with an object detection model like YOLO or a custom-trained convolutional neural network (CNN), which identifies objects in the 2D image and records their labels, sizes, and positions in a structured JSON format. Unreal Engine 5 then uses a custom C++ Actor to read this data, map it to appropriate 3D assets, and place them accurately in the game world. Experiments with varied test images—ranging from fruit arrangements to architectural layouts—demonstrated effective object detection and accurate 3D representation. The approach reduced manual workload, supported asset reuse, and retained visual consistency. This blend of computer vision and procedural design offers an innovative and scalable tool for game creators.

**Keywords:** AI in Game Design, Unreal Engine 5, Object Detection, Procedural Generation, 2D-3D Translation, Computer Vision

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