1. Introduction

Motivation
Importance of generating realistic polygons in applications (e.g., urban planning, simulation, virtual environments)

Challenge
Lack of objective, scalable criteria to compare realism across different generation algorithms

Proposed approach
Use a machine learning-based classifier as an evaluation tool to compare polygon generation algorithms

Main Contributions
- Design and implementation of multiple polygon generation algorithms
- Framework to evaluate realism using a classifier
- Quantitative and qualitative comparison of algorithm performance

Thesis Structure Overvie

2. Background and Related Work

Realistic Polygons
Characteristics of real-world polygons (e.g., building footprints, land parcels)

Polygon Generation Techniques
Overview of procedural, stochastic, and geometric approaches to polygon generation

Evaluation Methods for Geometric Objects
How realism or quality has been assessed in prior work

Machine Learning for Evaluation
Justification for using ML as an evaluation method; examples from similar domains

Evaluation Metrics
How realism has been evaluated in other domains

3. Evaluation Method: Classifier for Polygon Realism *(Tool Section)*

Data collection
- Sources of real-world polygons (Open street map, GIS datasets)
- Generation of non-realistic (negative) samples

Feature engineering
Geometric descriptors (e.g., number of vertices, convexity, area-to-perimeter ratio, etc.)

Classifier Training
- Choice of model (e.g. Random Forest, SVM) and justification
- Training procedure and evaluation metrics (accuracy, precision, etc.)

Validation

- Sanity checks to ensure classifier reliability
- Example classifications to show effectiveness

4. Polygon Generation Algorithms *(Main Focus)*

Algorithm 1 [e.g. Random Vertex Sampling]

- Description
- implementation details
- Parameters and expected outcomes
- pros/cons in realism context

Algorithm 2: [e.g., Voronoi-based Generation]

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Algorithm 3: [e.g., Recursive Subdivision or L-Systems]

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Algorithm 4: [Optional – Novel/Hybrid Method]

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Summary Table

Compare input requirements, complexity, and expected realism

5. Experimental Setup

Generation Protocol

- How many polygons per algorithm
- Parameter ranges
- Consistent conditions for fair comparison

Evaluation Workflow

- Feeding generated polygons into the classifier
- Metrics: % classified as realistic, distribution of realism scores

Other Evaluation Metrics *(optional)*

Diversity, compactness, visual appeal (if applicable)

6. Results and Comparison

Quantitative Results

- Realism classification per algorithm
- Statistical summaries (mean, std, etc.)

Visual Examples

- Representative polygons from each algorithm
- Comparison grids or plots (e.g., realism score distribution)

Analysis

- Which algorithms produce more realistic polygons and why?
- Strengths and weaknesses in context of realism
- Insights into parameter influence

7. Discussion

Implications
What the results mean for applications needing realistic polygons

Limitations
Classifier bias, dataset limitations, realism subjectivity

Possible Extensions
- Feedback loop for generation (e.g., realism score optimization)
- 3D polygon generation or time-evolving polygons
- Generative ML models (e.g., GANs for polygon creation)

8. Conclusion and Future Work
- Summary of Findings
- Best Performing Algorithm(s) and potential causes
- Future Work Directions: Algorithm refinement, better realism metrics, real-time generation

Appendices
- Classifier architecture and training details
- Algorithm pseudocode or implementation notes
- Additional generated examples

References
Polygon geometry, generation methods, classification techniques, datasets