

# Guarding an Art Gallery

(Polygonal Triangulations)

Prepared for: CS 154, Course Project

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## The Original Art Gallery Problem

Given the layout (map) of an art gallery what is the minimum number of stationary guards (CC TV cameras) needed to guard every point in the art gallery.

## The Art Gallery Theorem (AGT)

For any gallery with  $n$  walls  $\lceil n/3 \rceil$  cameras are always sufficient to guard the gallery.

## Problem Statement

Given the input of the boundary of art gallery as a simple polygon, we intend to find position of stationary guards (cameras) and also optimise the AGT solution for special classes of polygons.

## Solution Outline

We plan to use polygonal triangulation to triangulate the input polygon and then do a 3 colouring of the resulting graph having vertices as node and edges of polygon as edges of graph such that the minimum subset of coloured vertices represents the positions of cameras.

## Discussion

The original Art Gallery Problem is a NP Hard Problem. Therefore we wont be able to provide the minimum number of cameras in all cases. The Algorithm that we will be implementing (Fisk's Algorithm) provides minimum number of cameras in worst case for polygon of  $n$  sides, but for some polygons we can even optimise the AGT solution. For example in convex polygons we only require 1 camera.

We also plan to provide graphics such that we can determine area of sight of a camera, also additional features if time permits.

Packages/libraries we plan to use :

jack-posn

2D

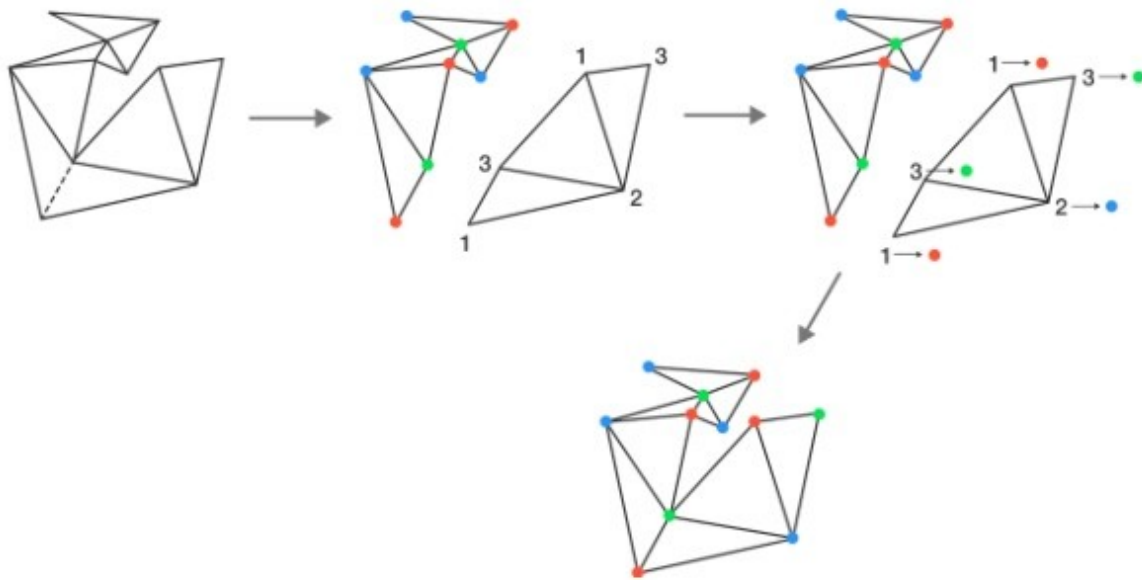
legacy

graph library and many others

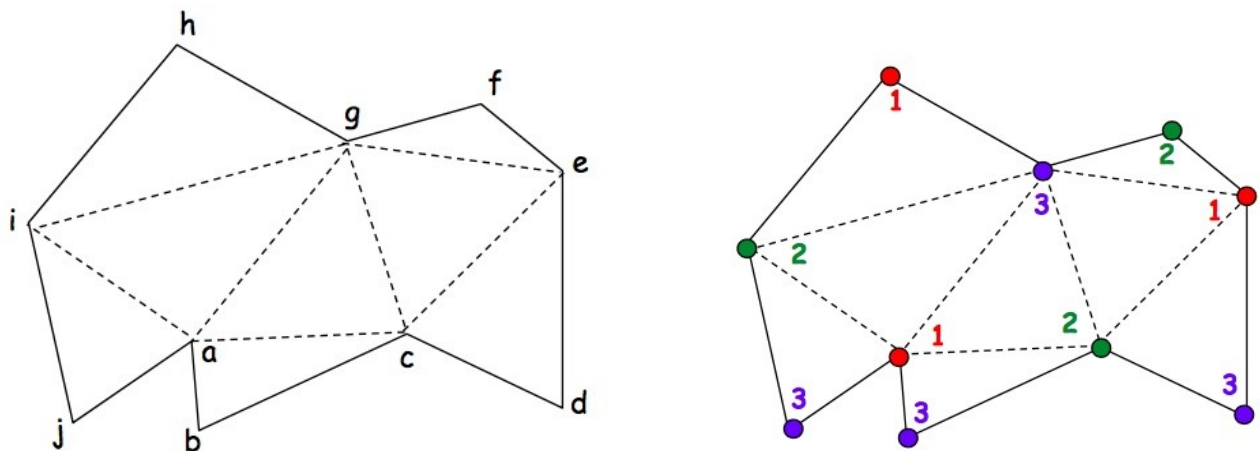
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## Project Proposal



The above figure represent triangulation of a polygon followed by the 3 coloring of resulting triangulated polygon



The vertices of same colour will give positions of cameras

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