**Programming Assignment:**

**Mesh Unfolding Heuristics**

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1. **Objective**

My goal is to provide an implementation of a couple of unfolding heuristics from ‘Schlickenrieder, Wolfram. “Nets of polyhedra." Master's Thesis, Technische Universität Berlin (1997).’

1. **Methods**

I chose two methods, which are “Greatest increase unfold” and “Rightmost ascending edge unfold” and I implemented them.

1. **Results**

I test my two method, which are “Greatest increase unfold” and “Rightmost ascending edge unfold” and also test “Steepest edge cut tree” and “Flat edge unfolding”. I will show the results of all four methods with five convex models and five non-convex models.

**A. Five convex models**

: I test the models; ball.obj, cone.obj, cube.obj, ellip.obj, pyramid2.obj in the “models/convex-models” folder

**(1) ball.obj**

**(a) Steepest edge cut tree**

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| **C:\Users\winYunhyk\Desktop\m\ball1_s.JPG** | **C:\Users\winYunhyk\Desktop\m\ball2_s.JPG** | **C:\Users\winYunhyk\Desktop\m\ball4_s.png** |
| (a-1) The ball model | (a-2) The unfolded ball model | (a-3) The tree graph of the ball model |

**(b) Flat edge unfolding**

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| **C:\Users\winYunhyk\Desktop\m\ball1_f.JPG** | **C:\Users\winYunhyk\Desktop\m\ball2_f.JPG** | **C:\Users\winYunhyk\Desktop\m\ball4_f.png** |
| (b-1) The ball model | (b-2) The unfolded ball model | (b-3) The tree graph of the ball model |

**(c) Greatest increase unfold**

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| **C:\Users\winYunhyk\Desktop\m\ball1_1.JPG** | **C:\Users\winYunhyk\Desktop\m\ball2_1.JPG** | **C:\Users\winYunhyk\Desktop\m\ball4_1.png** |
| (c-1) The ball model | (c-2) The unfolded ball model | (c-3) The tree graph of the ball model |

**(d) Rightmost ascending edge unfold**

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| **C:\Users\winYunhyk\Desktop\m\ball1_2.JPG** | **C:\Users\winYunhyk\Desktop\m\ball2_2.JPG** | overlapped |
| (d-1) The ball model | (d-2) The unfolded ball model | (d-3) The tree graph of the ball model |

**(2) cone.obj**

**(a) Steepest edge cut tree**

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| **C:\Users\winYunhyk\Desktop\m\cone1_s.JPG** | **C:\Users\winYunhyk\Desktop\m\cone2_s.JPG** | **C:\Users\winYunhyk\Desktop\m\cone4_s.png** |
| (a-1) The cone model | (a-2) The unfolded cone model | (a-3) The tree graph of the cone model |

**(b) Flat edge unfolding**

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| **C:\Users\winYunhyk\Desktop\m\cone1_f.JPG** | **C:\Users\winYunhyk\Desktop\m\cone2_f.JPG** | **C:\Users\winYunhyk\Desktop\m\cone4_f.png** |
| (b-1) The cone model | (b-2) The unfolded cone model | (b-3) The tree graph of the cone model |

**(c) Greatest increase unfold**

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| **C:\Users\winYunhyk\Desktop\m\cone1_1.JPG** | **C:\Users\winYunhyk\Desktop\m\cone2_1.JPG** | **C:\Users\winYunhyk\Desktop\m\cone4_1.png** |
| (c-1) The cone model | (c-2) The unfolded cone model | (c-3) The tree graph of the cone model |

**(d) Rightmost ascending edge unfold**

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| **C:\Users\winYunhyk\Desktop\m\cone1_2.JPG** | **C:\Users\winYunhyk\Desktop\m\cone2_2.JPG** | **C:\Users\winYunhyk\Desktop\m\cone4_2.png** |
| (d-1) The cone model | (d-2) The unfolded cone model | (d-3) The tree graph of the cone model |

**(3) cube.obj**

**(a) Steepest edge cut tree**

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| **C:\Users\winYunhyk\Desktop\m\cube1_s.JPG** | **C:\Users\winYunhyk\Desktop\m\cube2_s.JPG** | **C:\Users\winYunhyk\Desktop\m\cube4_s.png** |
| (a-1) The cube model | (a-2) The unfolded cube model | (a-3) The tree graph of the cube model |

**(b) Flat edge unfolding**

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| **C:\Users\winYunhyk\Desktop\m\cube1_f.JPG** | **C:\Users\winYunhyk\Desktop\m\cube2_f.JPG** | **C:\Users\winYunhyk\Desktop\m\cube4_f.png** |
| (b-1) The cube model | (b-2) The unfolded cube model | (b-3) The tree graph of the cube model |

**(c) Greatest increase unfold**

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| **C:\Users\winYunhyk\Desktop\m\cube1_1.JPG** |  | **C:\Users\winYunhyk\Desktop\m\cube4_1.png** |
| (c-1) The cube model | (c-2) The unfolded cube model | (c-3) The tree graph of the cube model |

**(d) Rightmost ascending edge unfold**

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| **C:\Users\winYunhyk\Desktop\m\cube1_2.JPG** | **C:\Users\winYunhyk\Desktop\m\cube2_2.JPG** | **C:\Users\winYunhyk\Desktop\m\cube4_2.png** |
| (d-1) The cube model | (d-2) The unfolded cube model | (d-3) The tree graph of the cube model |

**(4) ellip.obj**

**(a) Steepest edge cut tree**

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| **C:\Users\winYunhyk\Desktop\m\ellip1_s.JPG** | **C:\Users\winYunhyk\Desktop\m\ellip2_s.JPG** | **C:\Users\winYunhyk\Desktop\m\ellip4_s.png** |
| (a-1) The ellip model | (a-2) The unfolded ellip model | (a-3) The tree graph of the ellip model |

**(b) Flat edge unfolding**

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| **C:\Users\winYunhyk\Desktop\m\ellip1_f.JPG** | **C:\Users\winYunhyk\Desktop\m\ellip2_f.JPG** | **C:\Users\winYunhyk\Desktop\m\ellip4_f.png** |
| (b-1) The ellip model | (b-2) The unfolded ellip model | (b-3) The tree graph of the ellip model |

**(c) Greatest increase unfold**

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| **C:\Users\winYunhyk\Desktop\m\ellip1_1.JPG** | **C:\Users\winYunhyk\Desktop\m\ellip2_1.JPG** | **C:\Users\winYunhyk\Desktop\m\ellip4_1.png** |
| (c-1) The ellip model | (c-2) The unfolded ellip model | (c-3) The tree graph of the ellip model |

**(d) Rightmost ascending edge unfold**

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| **C:\Users\winYunhyk\Desktop\m\ellip1_2.JPG** | **C:\Users\winYunhyk\Desktop\m\ellip2_2.JPG** | **C:\Users\winYunhyk\Desktop\m\ellip4_2.png** |
| (d-1) The ellip model | (d-2) The unfolded ellip model | (d-3) The tree graph of the ellip model |

**(5) v-rod.obj**

**(a) Steepest edge cut tree**

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| **C:\Users\winYunhyk\Desktop\m\v-rod1_s.JPG** | **C:\Users\winYunhyk\Desktop\m\v-rod2_s.JPG** | **C:\Users\winYunhyk\Desktop\m\v-rod4_s.png** |
| (a-1) The v-rod model | (a-2) The unfolded v-rod model | (a-3) The tree graph of the v-rod model |

**(b) Flat edge unfolding**

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| --- | --- | --- |
| **C:\Users\winYunhyk\Desktop\m\v-rod1_f.JPG** | **C:\Users\winYunhyk\Desktop\m\v-rod2_f.JPG** | **C:\Users\winYunhyk\Desktop\m\v-rod4_f.png** |
| (b-1) The v-rod model | (b-2) The unfolded v-rod model | (b-3) The tree graph of the v-rod model |

**(c) Greatest increase unfold**

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| **C:\Users\winYunhyk\Desktop\m\v-rod1_1.JPG** | **C:\Users\winYunhyk\Desktop\m\v-rod2_1.JPG** | **C:\Users\winYunhyk\Desktop\m\v-rod4_1.png** |
| (c-1) The v-rod model | (c-2) The unfolded v-rod model | (c-3) The tree graph of the v-rod model |

**(d) Rightmost ascending edge unfold**

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| **C:\Users\winYunhyk\Desktop\m\v-rod1_2.JPG** | **C:\Users\winYunhyk\Desktop\m\v-rod2_2.JPG** | **C:\Users\winYunhyk\Desktop\m\v-rod4_2.png** |
| (d-1) The v-rod model | (d-2) The unfolded v-rod model | (d-3) The tree graph of the v-rod model |

**B. Five non-convex models**

: I test the models; star-9split.obj, bunny-348.obj, kitten-122.obj, hand-336.obj, tower-412.obj in the “models” folder

**(1) star-9split.obj**

**(a) Steepest edge cut tree**

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| **C:\Users\winYunhyk\Desktop\resultImage\star-9split1_s.JPG** | **C:\Users\winYunhyk\Desktop\resultImage\star-9split2_s.JPG** |
| (a-1) The star-9split model | (a-2) The unfolded star-9split model |

**(b) Flat edge unfolding**

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| **C:\Users\winYunhyk\Desktop\resultImage\star-9split1_f.JPG** | **C:\Users\winYunhyk\Desktop\resultImage\star-9split2_f.JPG** |
| (b-1) The star-9split model | (b-2) The unfolded star-9split model |

**(c) Greatest increase unfold**

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| **C:\Users\winYunhyk\Desktop\resultImage\star-9split1_1.JPG** | **C:\Users\winYunhyk\Desktop\resultImage\star-9split2_1.JPG** |
| (c-1) The star-9split model | (c-2) The unfolded star-9split model |

**(d) Rightmost ascending edge unfold**

|  |  |
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| **C:\Users\winYunhyk\Desktop\resultImage\star-9split1_2.JPG** | **C:\Users\winYunhyk\Desktop\resultImage\star-9split2_2.JPG** |
| (d-1) The star-9split model | (d-2) The unfolded star-9split model |

**(2) bunny-348.obj**

**(a) Steepest edge cut tree**

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| **C:\Users\winYunhyk\Desktop\resultImage\bunny-3481_s.JPG** | **C:\Users\winYunhyk\Desktop\resultImage\bunny-3482_s.JPG** |
| (a-1) The bunny-348 model | (a-2) The unfolded bunny-348 model |

**(b) Flat edge unfolding**

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| **C:\Users\winYunhyk\Desktop\resultImage\bunny-3481_f.JPG** | **C:\Users\winYunhyk\Desktop\resultImage\bunny-3482_f.JPG** |  |
| (b-1) The bunny-348 model | (b-2) The unfolded bunny-348 model | (b-3) The tree graph of the bunny-348 model |

**(c) Greatest increase unfold**

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| **C:\Users\winYunhyk\Desktop\resultImage\bunny-3481_1.JPG** | **C:\Users\winYunhyk\Desktop\resultImage\bunny-3482_1.JPG** |  |
| (c-1) The bunny-348 model | (c-2) The unfolded bunny-348 model | (c-3) The tree graph of the bunny-348 model |

**(d) Rightmost ascending edge unfold**

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| **C:\Users\winYunhyk\Desktop\resultImage\bunny-3481_2.JPG** | **C:\Users\winYunhyk\Desktop\resultImage\bunny-3482_2.JPG** |  |
| (d-1) The bunny-348 model | (d-2) The unfolded bunny-348 model | (d-3) The tree graph of the bunny-348 model |

**(3) kitten-122.off**

**(a) Steepest edge cut tree**

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| **C:\Users\winYunhyk\Desktop\resultImage\kitten-1221_s.JPG** | **C:\Users\winYunhyk\Desktop\resultImage\kitten-1222_s.JPG** |  |
| (a-1) The kitten-122 model | (a-2) The unfolded kitten-122 model | (a-3) The tree graph of the kitten-122 model |

**(b) Flat edge unfolding**

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| **C:\Users\winYunhyk\Desktop\resultImage\kitten-1221_f.JPG** | **C:\Users\winYunhyk\Desktop\resultImage\kitten-1222_f.JPG** |  |
| (b-1) The kitten-122 model | (b-2) The unfolded kitten-122 model | (b-3) The tree graph of the kitten-122 model |

**(c) Greatest increase unfold**

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| **C:\Users\winYunhyk\Desktop\resultImage\kitten-1221_1.JPG** | **C:\Users\winYunhyk\Desktop\resultImage\kitten-1222_1.JPG** |  |
| (c-1) The kitten-122 model | (c-2) The unfolded kitten-122 model | (c-3) The tree graph of the kitten-122 model |

**(d) Rightmost ascending edge unfold**

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| **C:\Users\winYunhyk\Desktop\resultImage\kitten-1221_2.JPG** | **C:\Users\winYunhyk\Desktop\resultImage\kitten-1222_2.JPG** |  |
| (d-1) The kitten-122 model | (d-2) The unfolded kitten-122 model | (d-3) The tree graph of the kitten-122 model |

**(4) hand-336.off**

**(a) Steepest edge cut tree**

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| **C:\Users\winYunhyk\Desktop\resultImage\hand-3361_s.JPG** | **C:\Users\winYunhyk\Desktop\resultImage\hand-3362_s.JPG** |  |
| (a-1) The hand-336 model | (a-2) The unfolded hand-336 model | (a-3) The tree graph of the hand-336 model |

**(b) Flat edge unfolding**

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| **C:\Users\winYunhyk\Desktop\resultImage\hand-3361_f.JPG** | **C:\Users\winYunhyk\Desktop\resultImage\hand-3362_f.JPG** |  |
| (b-1) The hand-336 model | (b-2) The unfolded hand-336 model | (b-3) The tree graph of the hand-336 model |

**(c) Greatest increase unfold**

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| **C:\Users\winYunhyk\Desktop\resultImage\hand-3361_1.JPG** | **C:\Users\winYunhyk\Desktop\resultImage\hand-3362_1.JPG** |  |
| (c-1) The hand-336 model | (c-2) The unfolded hand-336 model | (c-3) The tree graph of the hand-336 model |

**(d) Rightmost ascending edge unfold**

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| **C:\Users\winYunhyk\Desktop\resultImage\hand-3361_2.JPG** | **C:\Users\winYunhyk\Desktop\resultImage\hand-3362_2.JPG** |  |
| (d-1) The hand-336 model | (d-2) The unfolded hand-336 model | (d-3) The tree graph of the hand-336 model |

**(5) tower-412.obj**

**(a) Steepest edge cut tree**

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| **C:\Users\winYunhyk\Desktop\resultImage\tower-4121_s.JPG** | **C:\Users\winYunhyk\Desktop\resultImage\tower-4122_s.JPG** |  |
| (a-1) The tower-412 model | (a-2) The unfolded tower-412 model | (a-3) The tree graph of the tower-412 model |

**(b) Flat edge unfolding**

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| **C:\Users\winYunhyk\Desktop\resultImage\tower-4121_f.JPG** | **C:\Users\winYunhyk\Desktop\resultImage\tower-4122_f.JPG** |  |
| (b-1) The tower-412 model | (b-2) The unfolded tower-412 model | (b-3) The tree graph of the tower-412 model |

**(c) Greatest increase unfold**

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| **C:\Users\winYunhyk\Desktop\resultImage\tower-4121_1.JPG** |  |  |
| (c-1) The tower-412 model | (c-2) The unfolded tower-412 model | (c-3) The tree graph of the tower-412 model |

**(d) Rightmost ascending edge unfold**

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| **C:\Users\winYunhyk\Desktop\resultImage\tower-4121_2.JPG** | **C:\Users\winYunhyk\Desktop\resultImage\tower-4122_2.JPG** |  |
| (d-1) The tower-412 model | (d-2) The unfolded tower-412 model | (d-3) The tree graph of the tower-412 model |

1. **Foundings**

Report your foundings.

If your implementation has bugs, report the bugs as well.