Estimation of Interpolation Error in DEMs using Statistical Methods

Estimation of Interpolation Errors using Statistical Methods – Dr Robert Pâquet
Mine Safety Operations – 13 April 2010

Introduction

- Error in DEMs:
- Inaccuracy
  - Volume calculations
  - Deformation estimation
  - Flood Path
  - Etc

Potential outcome: $$$, court battles

Introduction

- Error estimation:

$$E_{DEM} = \sqrt{E^2_{Interpolation} + E^2_{The\ rest}}$$

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Introduction

- Problem: Estimation of Interpolation Error
- Solution: Statistical Tools
  (well, anyway, one solution)

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The Data

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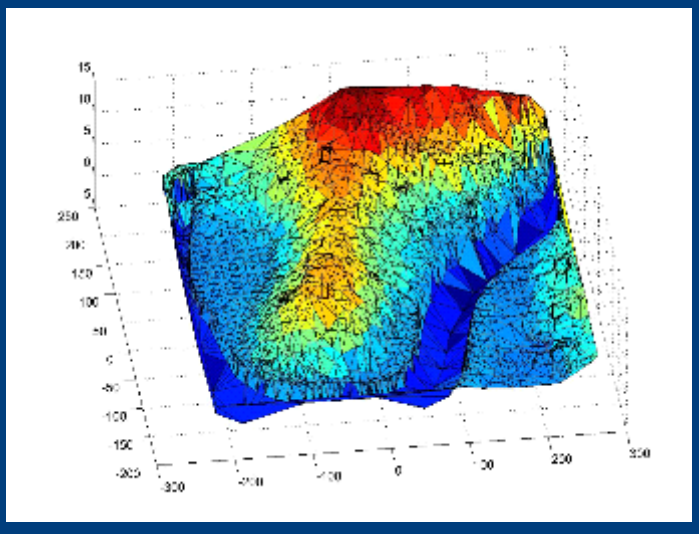
The Data



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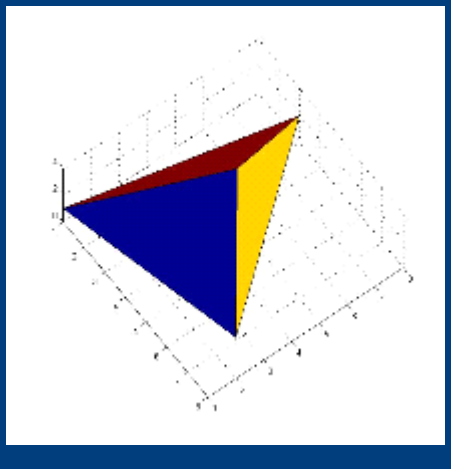
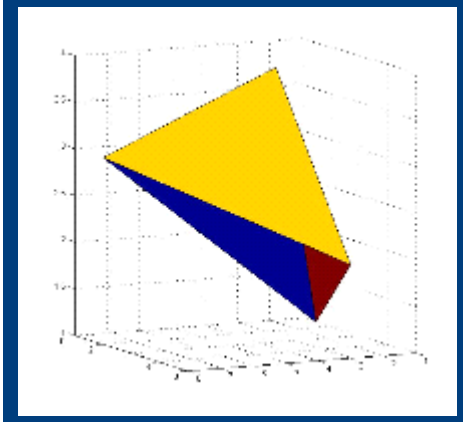
Trick Time:





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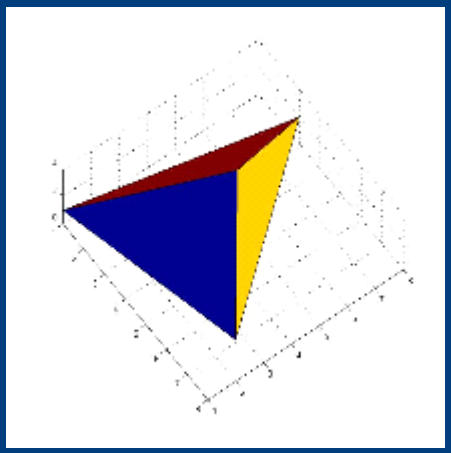
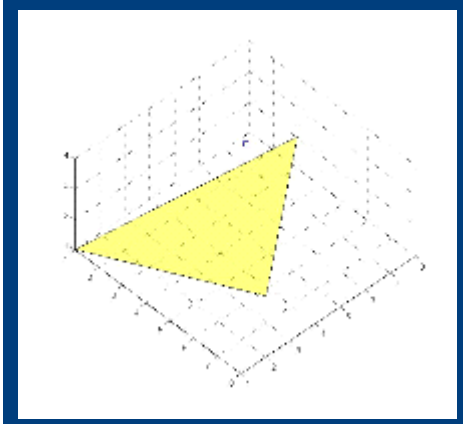
Trick Time:





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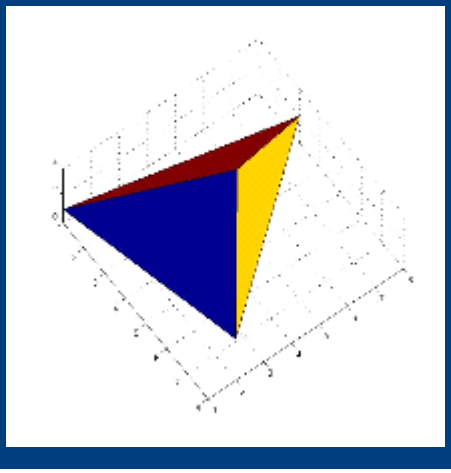
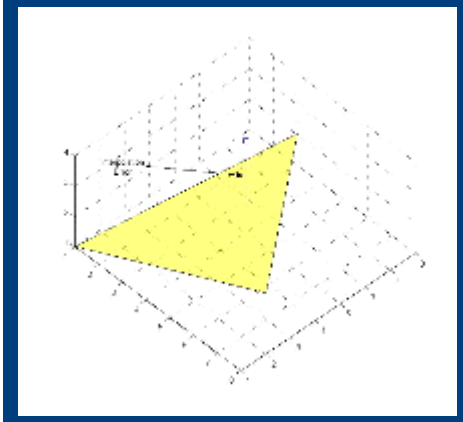
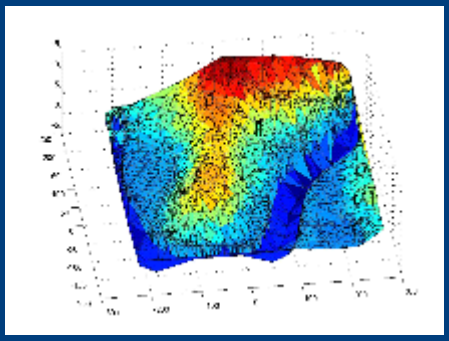
Trick Time: one exact answer!





Method:

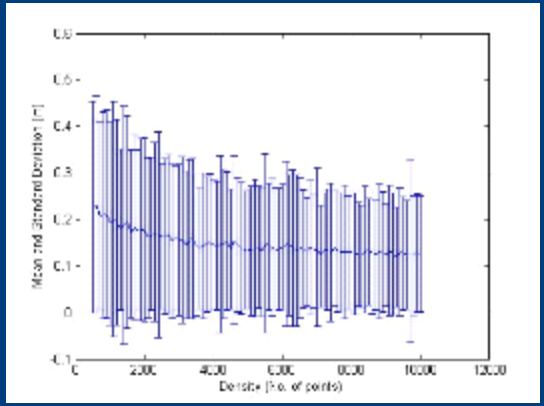
- 27,704 pts
- 1) Pick 25 pts randomly
- 2) Thin-out to 26k pts (randomly)
- 3) Calculate error w/ 25 pts
- 4) Do that (steps 1-3) 25 times
- 5) Store statistics for that density
- Repeat 1-5 with 25,750 pts and again for 102 decrements (of 250pts)



DEM Islington Park

Results:

- Plot Mean and SD Vs Density
- 64,375 calculations
- 2,466.4 seconds



Mean and SD Interpolation Error Vs Density

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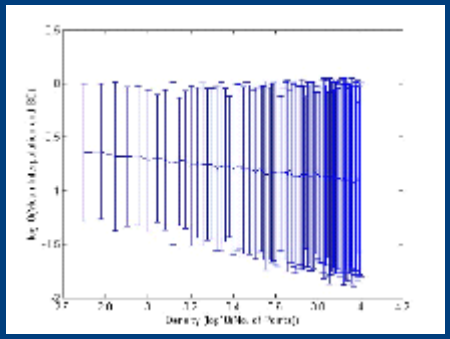
Method part 2: Linear Regression

- To use linear regression, need to transform the data
- Log log transformation in this case
- SD 'megaphone' shape (use cautiously)



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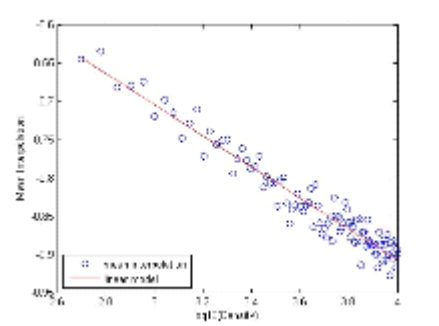
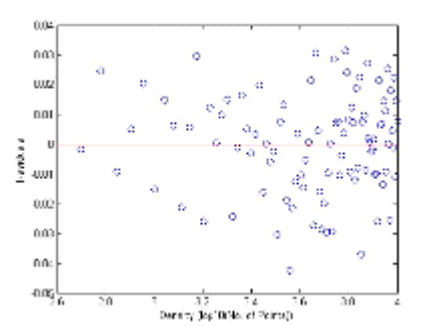
Linear Model





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Conclusion

- This method validates the interpolation error
- Essential to design survey to fit the error budget

(Remember: $E_{DEM} = \sqrt{E^2_{Interpolation} + E^2_{Obs.\ acc.}}$)

- For this experiment, 64k calcs, 2466 seconds, hardly worth not having?

The End, thanks

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