ReCap Pro – What's New and Advanced Topics AS125538-L

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Software Development Manager, Autodesk, Inc. Reality Solutions

ReCap & Reality Capture at Autodesk

Overview

- ReCap 1.0 Launched in 2013
- Current Release: 4.2.1.7
- Hardware agnostic laser scan and point cloud processing
- Photogrammetry

The ReCap Portfolio

- ReCap Pro for desktop
- ReCap Pro for mobile
- ReCap Photo
- Web Publishing, Viewing, and Sharing at recap.autodesk.com
- Portfolio Point Cloud Support (AutoCAD, Revit, Inventor …)
- Reality Capture Forge API

ReCap Enables User to Leverage Captured Reality for Design and Creation

About Me

- Marc Zinck
- Software Development Manager, Reality Solutions Group
- Lead development of ReCap Pro for desktop
- Based in Pittsburgh, PA, United States
- Joined Autodesk through a the acquisition of a startup focused on automated point cloud processing and commercializing robotic perception algorithms in 2012.

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Workshop Datasets

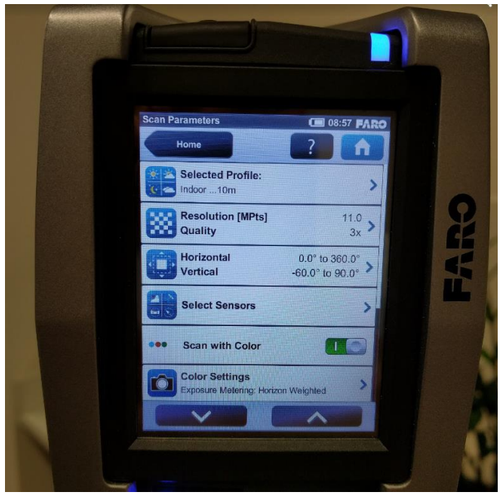
Download Datasets

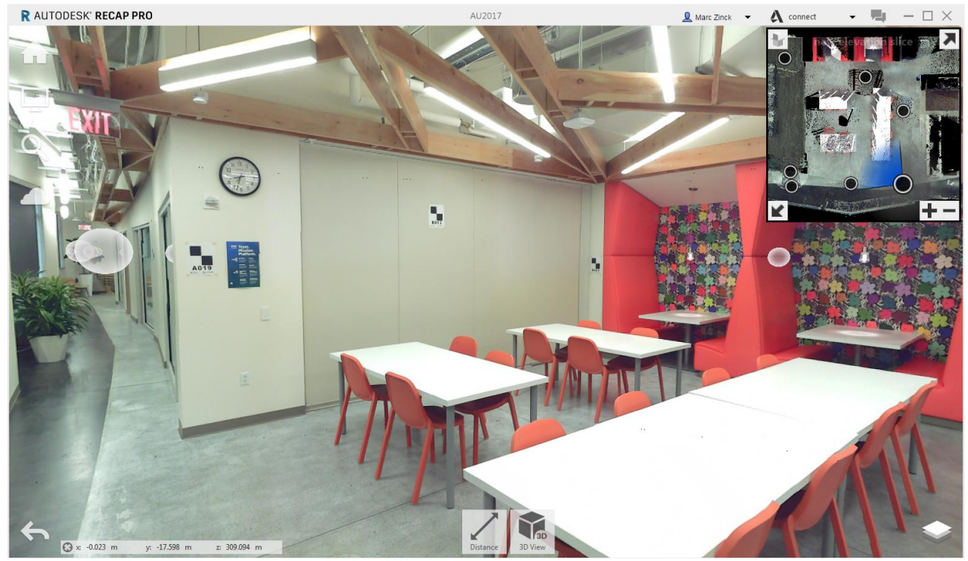
The datasets for this class can be downloaded from the following URL

https://autodesk.box.com/v/AU2017-AS12558-L

Dataset

- Interior Terrestrial Scans with Color
- Faro Focus 120
- Medium Resolution (~11 Mpts / Scan) at 3x quality
- Color Exposure: Horizon Weighted
- Office Environment

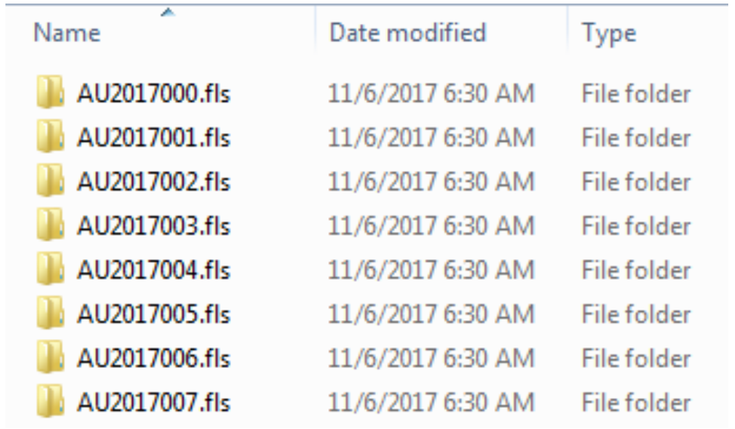




Dataset used today will be made available for download

Dataset Folder Structure

- Scans
  - AU2017000.fls … AU2017016.fls
  - Preview
- ReCap
  - AU2017.rcp, AU2017 A.rcp, AU2017 C.rcp, AU2017 D.rcp (no B) Support Folders
  - AU2017 Unified
    - au2017Unified.rcs
- Models
  - Table, Chair, Car (nwd, dwg, …)
- Mesh
  - AU2017 D Booth.rcm, obj.zip
- Targets
- Docs

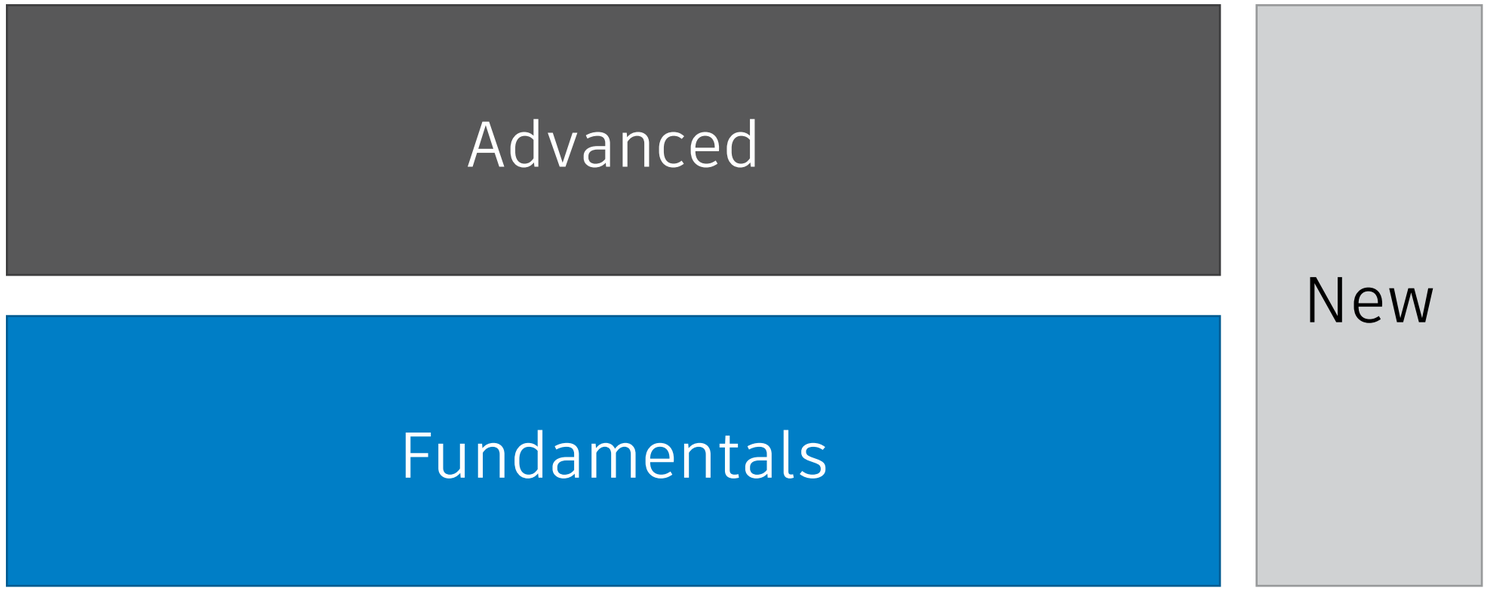


Exercise #0: Review Data & Backup RCP Files

Themes & Outline

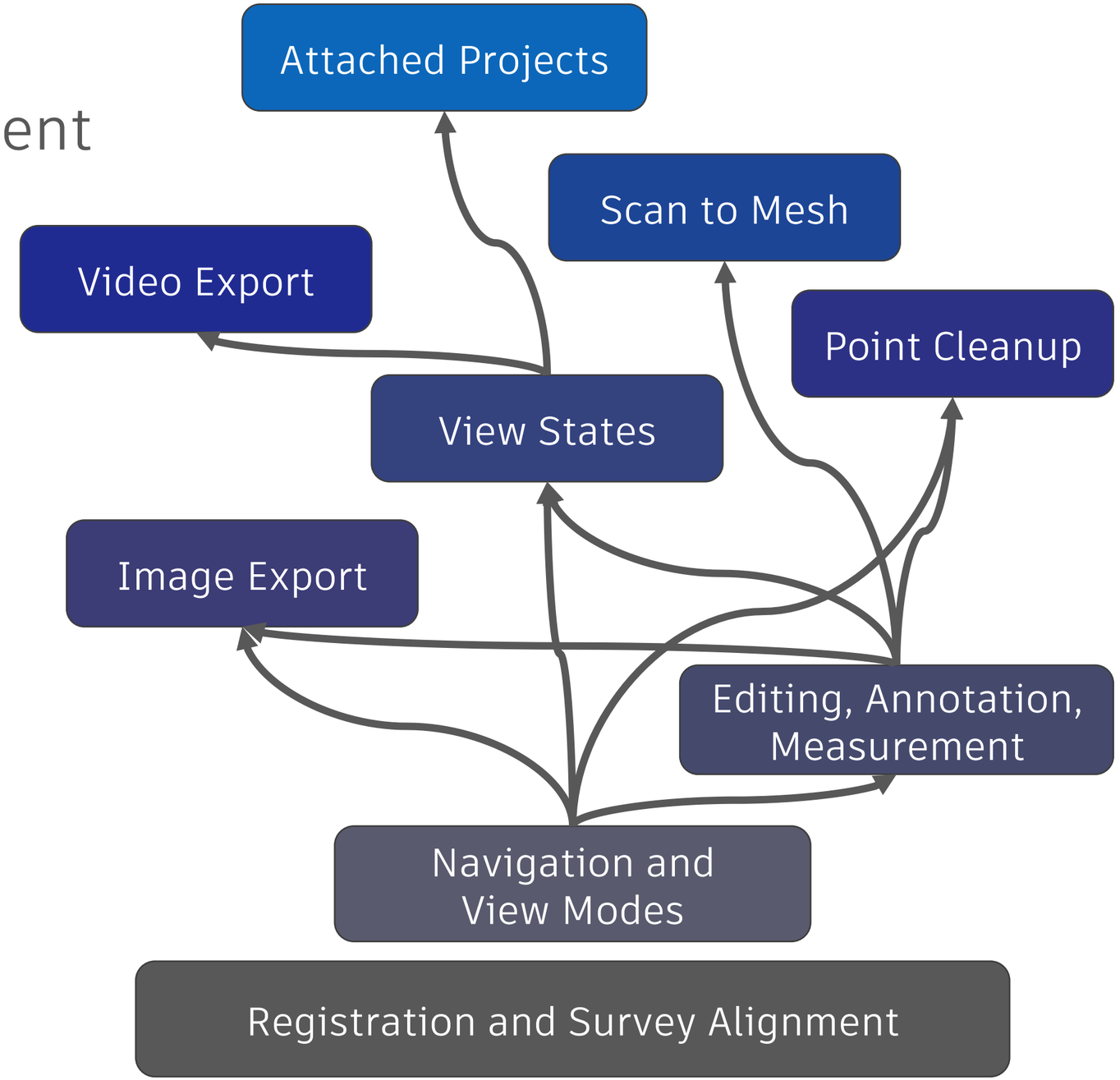
Themes

- Fundamentals, New, and Advanced



Outline

- Registration & Survey Alignment
- Navigation & View Modes
- Editing, Annotation & Measurement
- Image Export
- View States
- Video Export
- Scan to Mesh
- Attached Projects
- Point Cleanup
- Unification with RealViews



Registration

Registration and Survey Alignment

- Registration Metrics
  - Overlap, Balance, Quality
- Developing Confidence in Cloud To Cloud Registration
  - Understanding the Registration Report
  - Validating Registration with Targets
- Resuming Registration after Suspend
- Survey Alignment with Targets

Exercise #1: Understanding Registration Metrics

Understanding Registration Metrics (intuitive)

- **Overlap**: **Amount** used in registration.

- **Balance**: **Constraint** on placement of the scan given the features in the region of overlap.

- **Quality (%<6mm)**: **Consistency** of data with regards to other scans in the region of overlap.

Understanding Registration Metrics (technical)

- **Overlap**: Percentage of the suitable data in the scan use in registration.

- **Balance**: Normalized ratio of the *smallest* eigen value to the sum of all three eigen values of feature-normals in the region of overlap.

- **Quality (%<6mm)**: Percentage of points, in the region of overlap, which are within six millimeters of points in other scans.

Understanding Registration Metrics (practical)

- **Overlap**: Low values deserve a second look. – Is the scan station density appropriate for the environment?

- **Balance**: Value should reflect scene geometry. Low for corridors and exteriors, high for well defined rooms.

- **Quality (%<6mm)**: Scene does not contain sufficiently strong features. Possible hardware issue. Increased likelihood of poor registration. Scene may contain noisy features (grass, trees).

Understanding Registration Metrics (causes)

- **Overlap**: Scan Station Density
- **Balance**: Scene Geometry & Scan Station Placement
- **Quality (%<6mm)**: Scene Materials, Sensor Stability, Sensor Issues

Understanding Registration Metrics (thresholds)

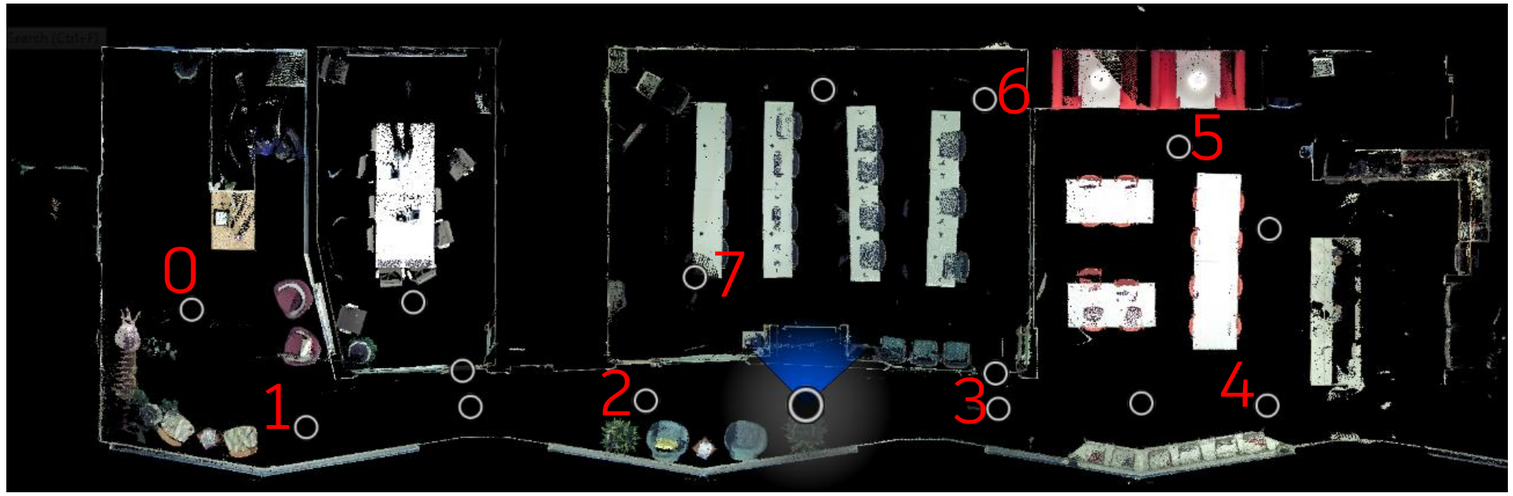
- Overlap: 100%-15% 15%-5% 5%-0%

- Balance: 100-25% 25%-5% 5%-0%

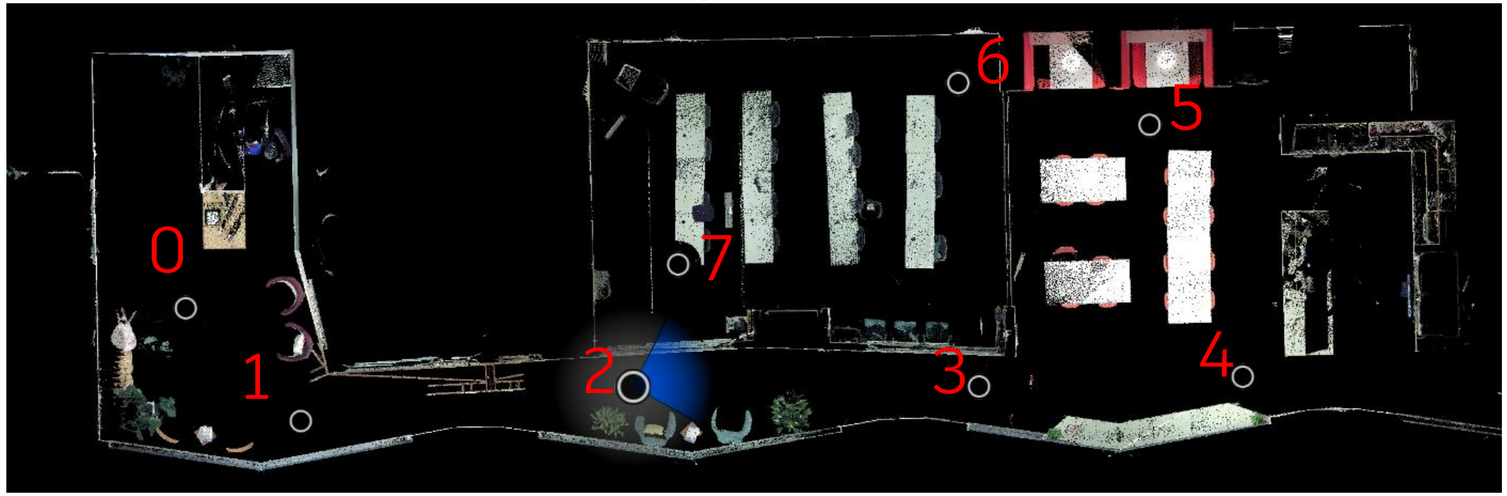
- Quality (%<6mm): 100%-92% 92%-85% 85%-0%

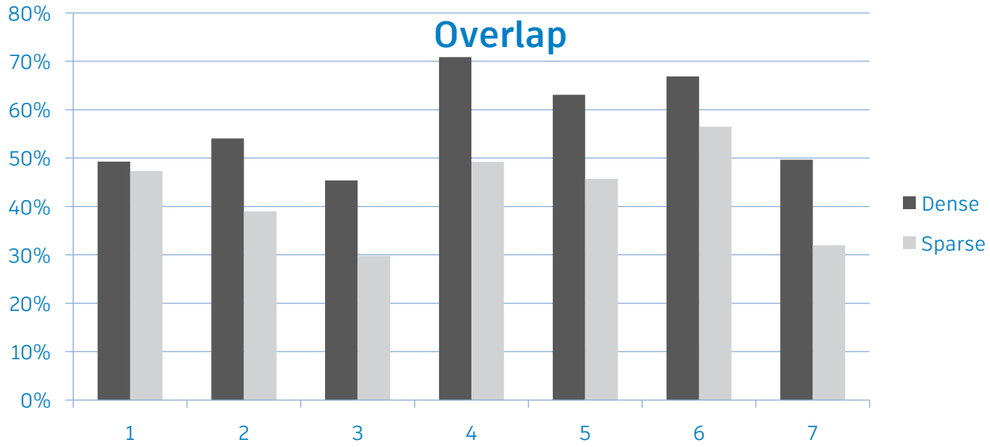
Dense vs. Sparse: Overlap & Balance

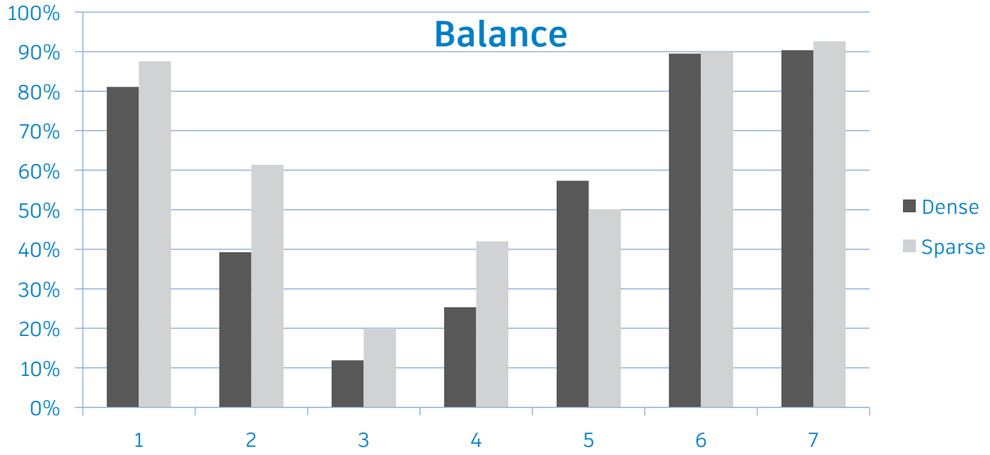
Dense



Sparse

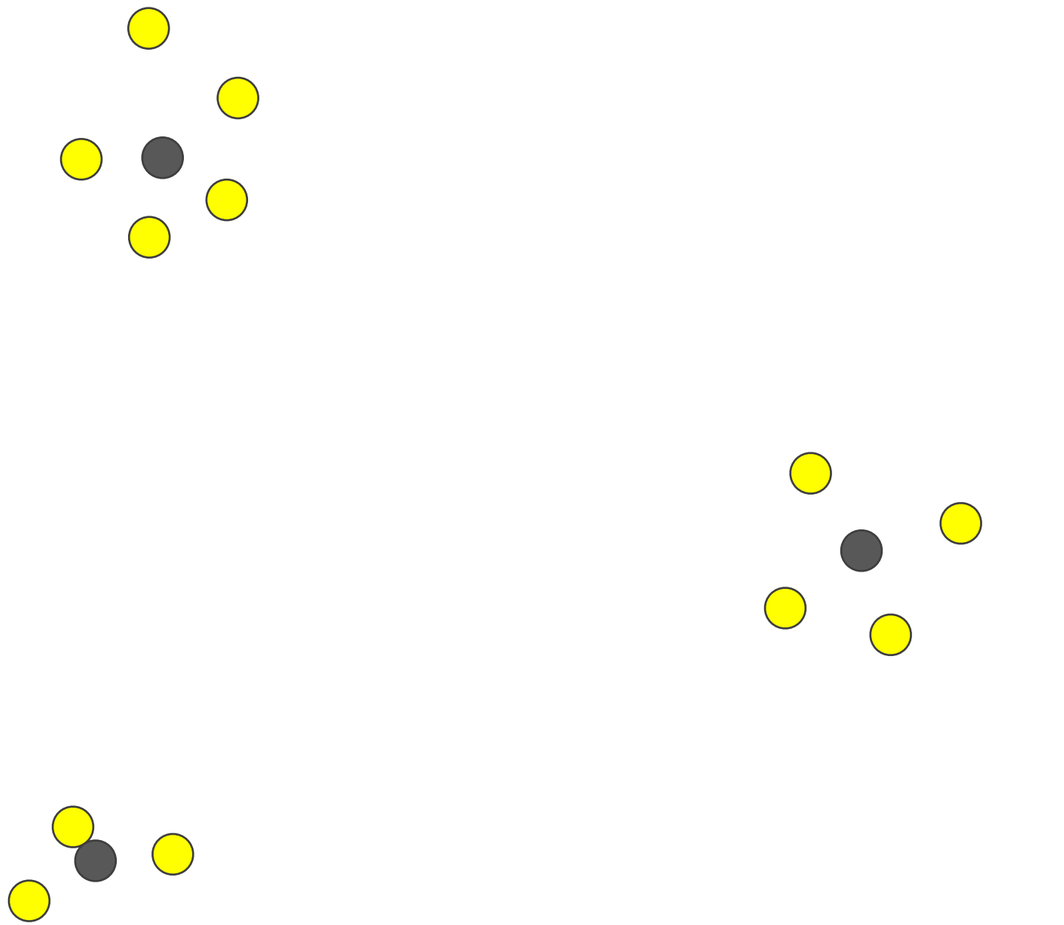


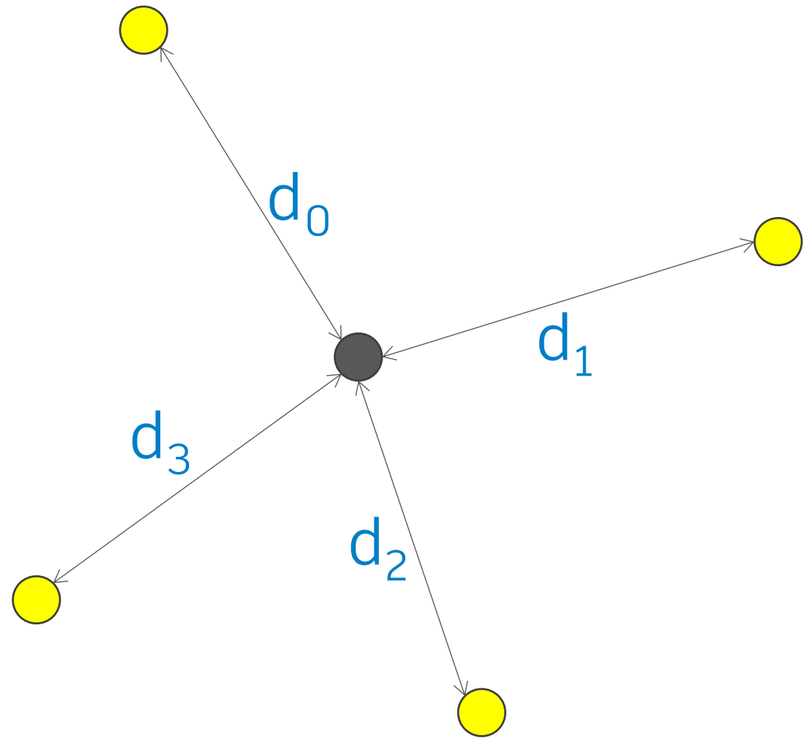




Exercise #2: Confidence in Registration

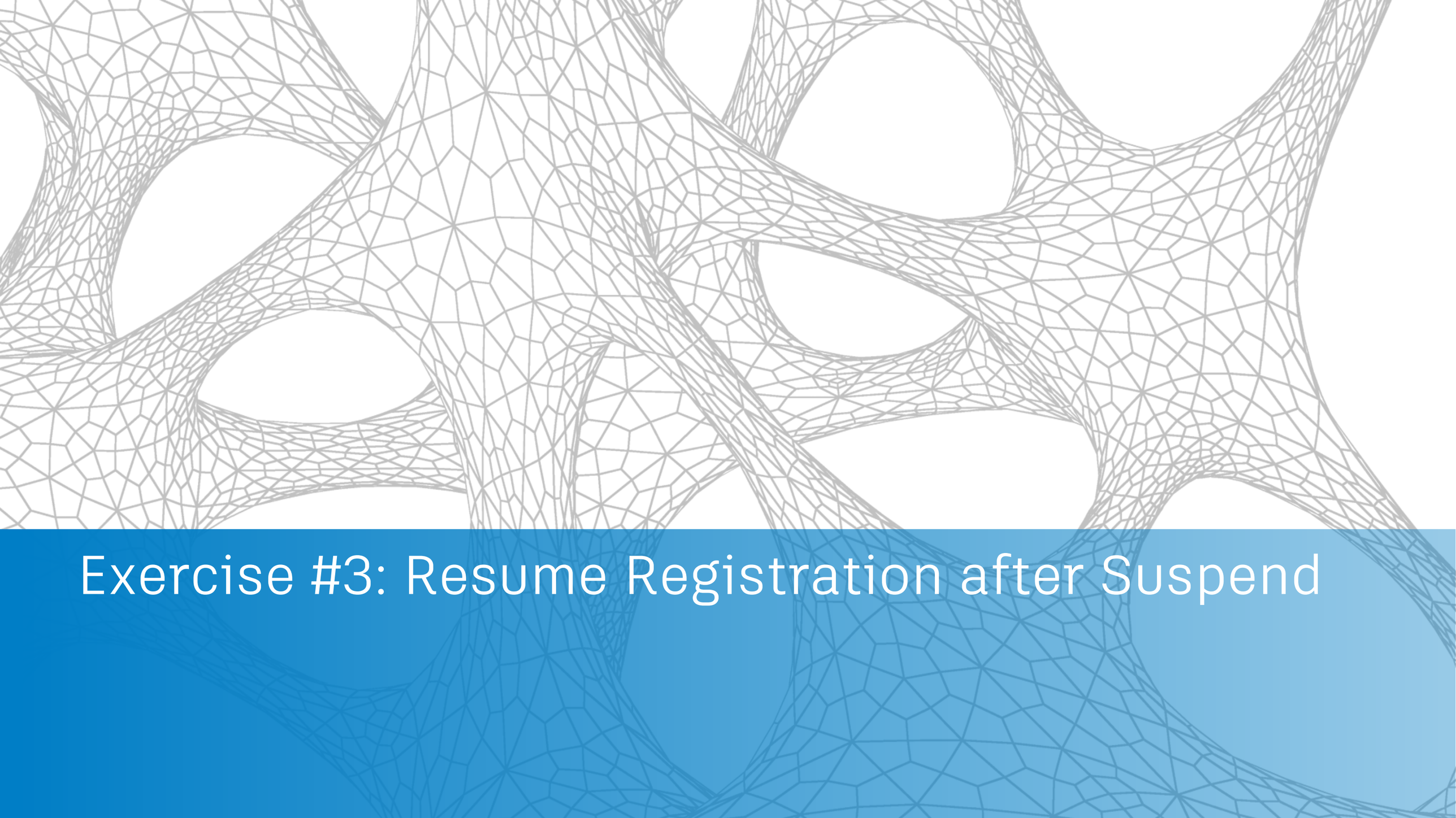
Understanding the Registration Report (Target RMS)





$$RMS = (d_0^2 + d_1^2 + d_2^2 + d_3^2)^{1/2}$$

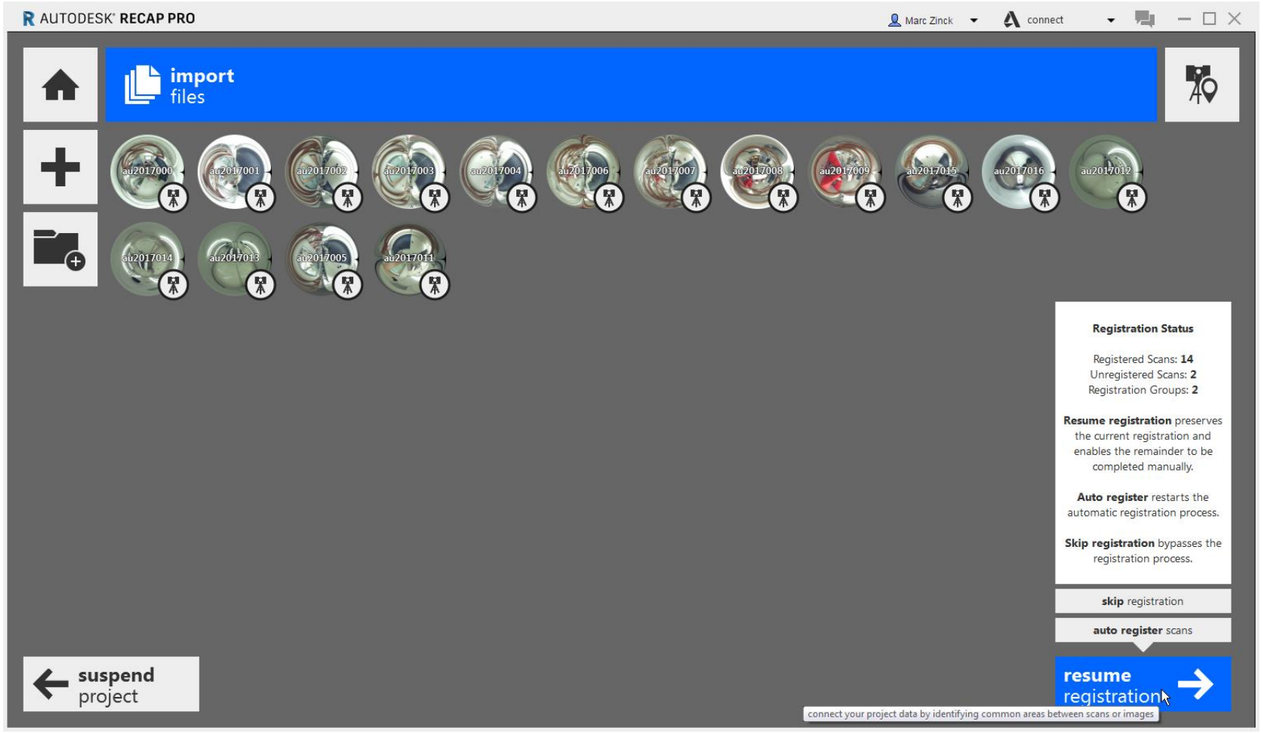
Exaggerated Scale

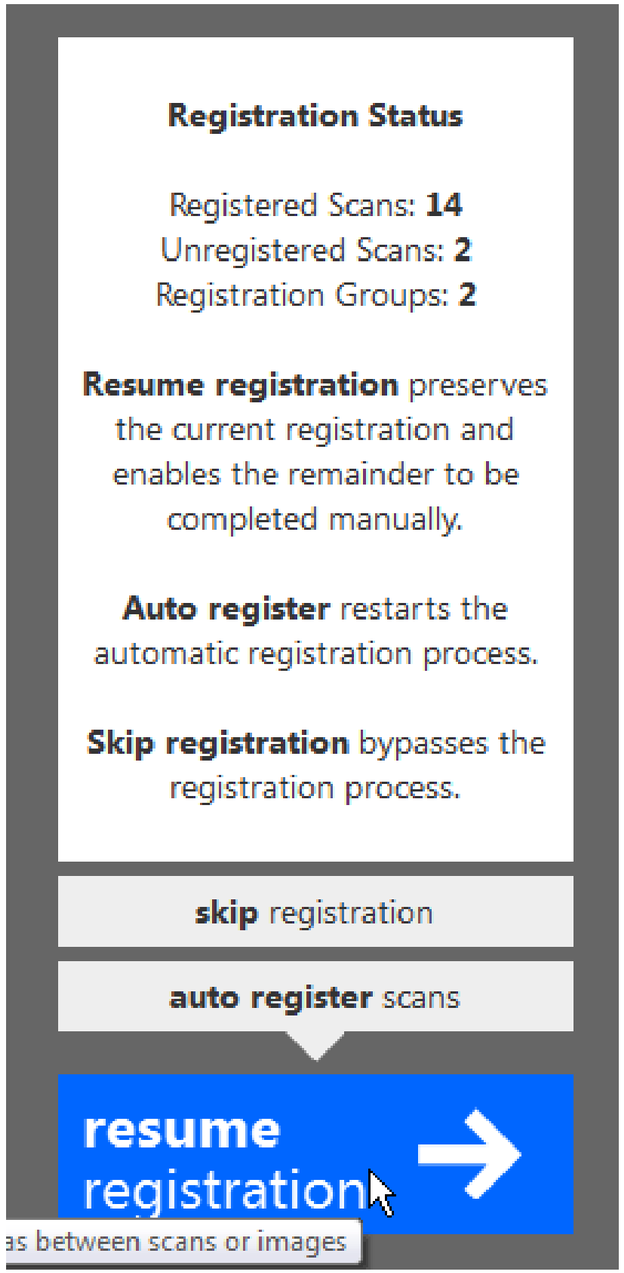


Exercise #3: Resume Registration after Suspend

Registration Status

- Quickly Assess Current Status
- Help Determine Next Step (auto / manual)





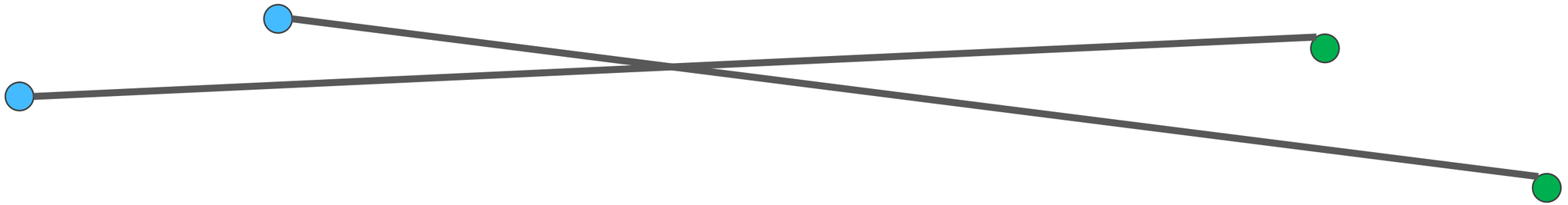
Exercise #4: Survey Alignment With Targets

Understanding Survey Alignment

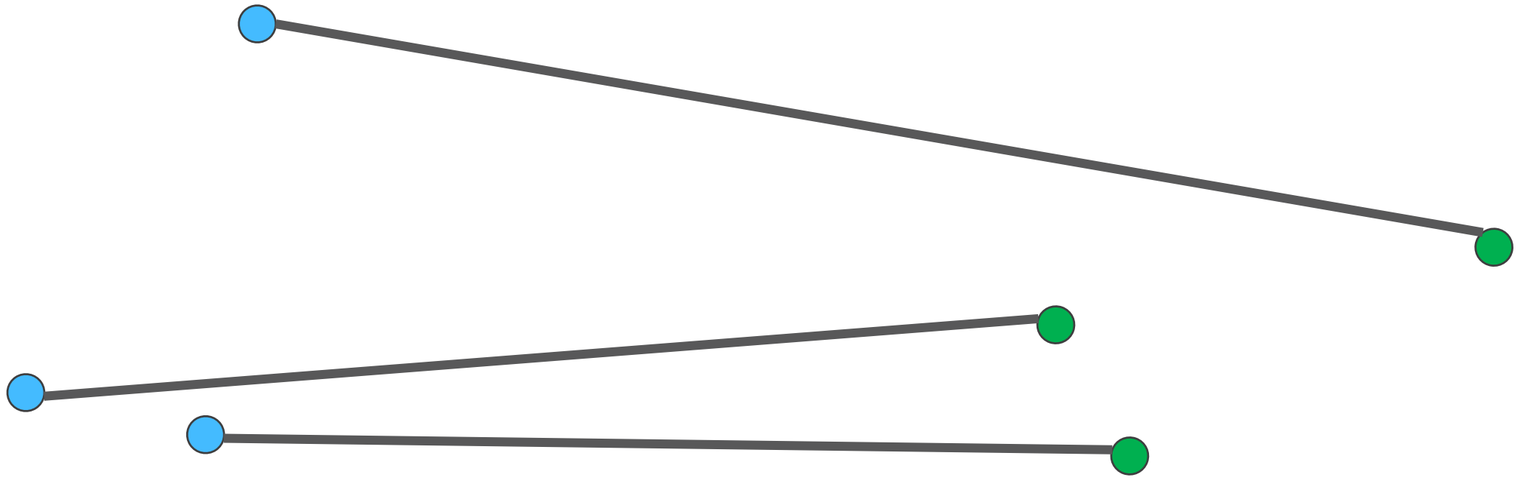
Extracted Targets

Survey Coordinates

Understanding Survey Alignment



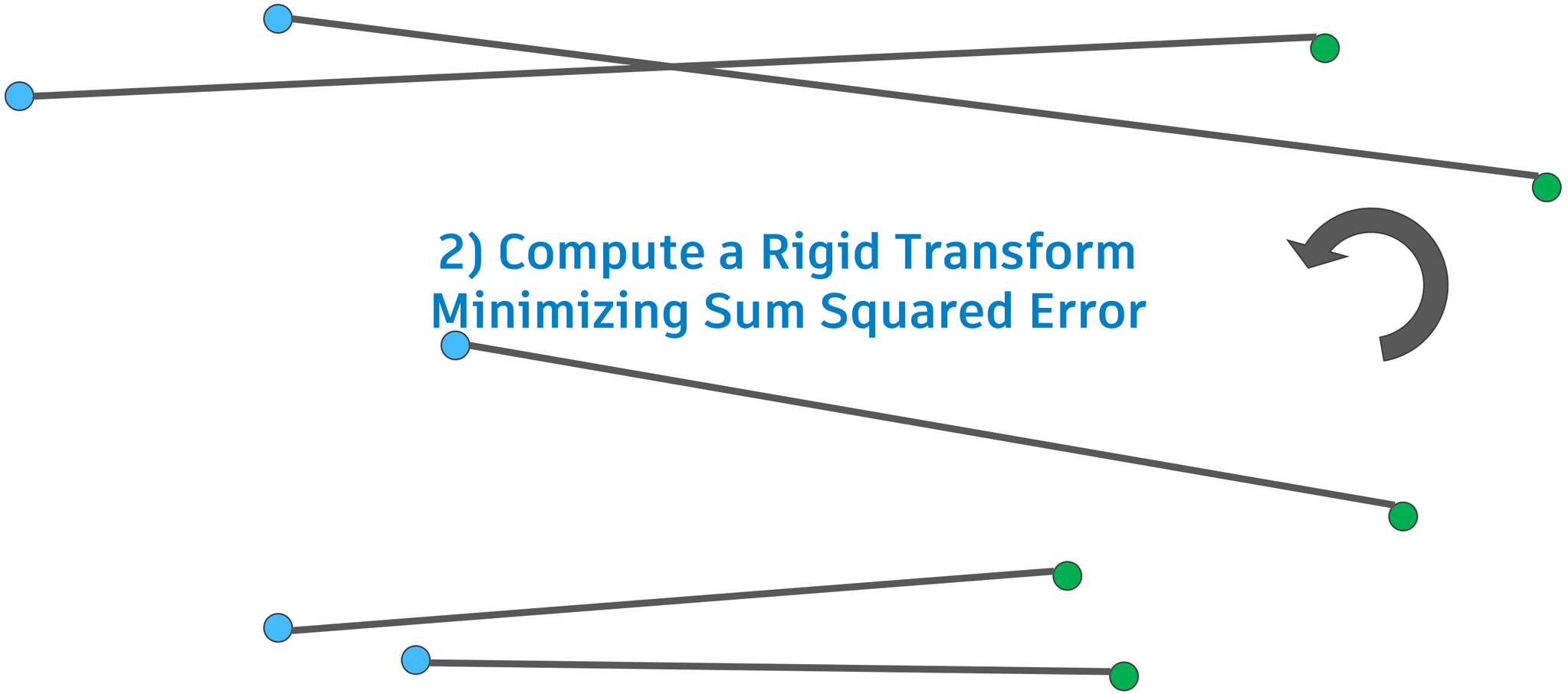
1) Establish a Correspondence



Extracted Targets

Survey Coordinates

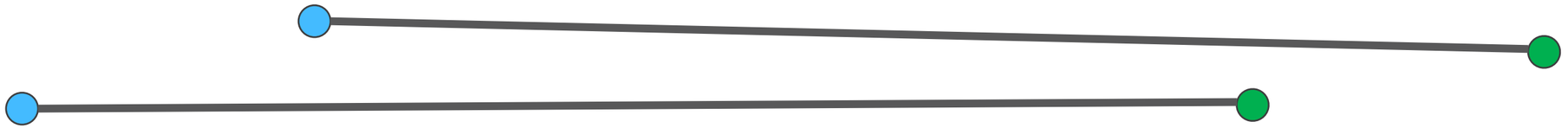
Understanding Survey Alignment



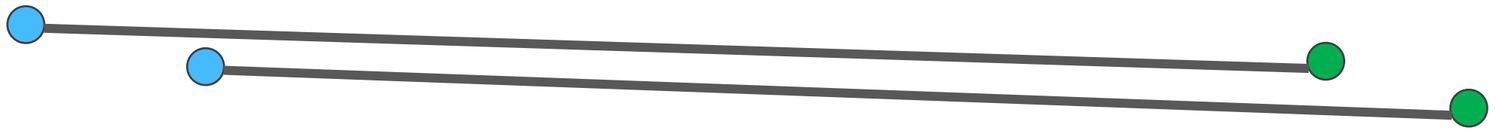
Extracted Targets

Survey Coordinates

Understanding Survey Alignment



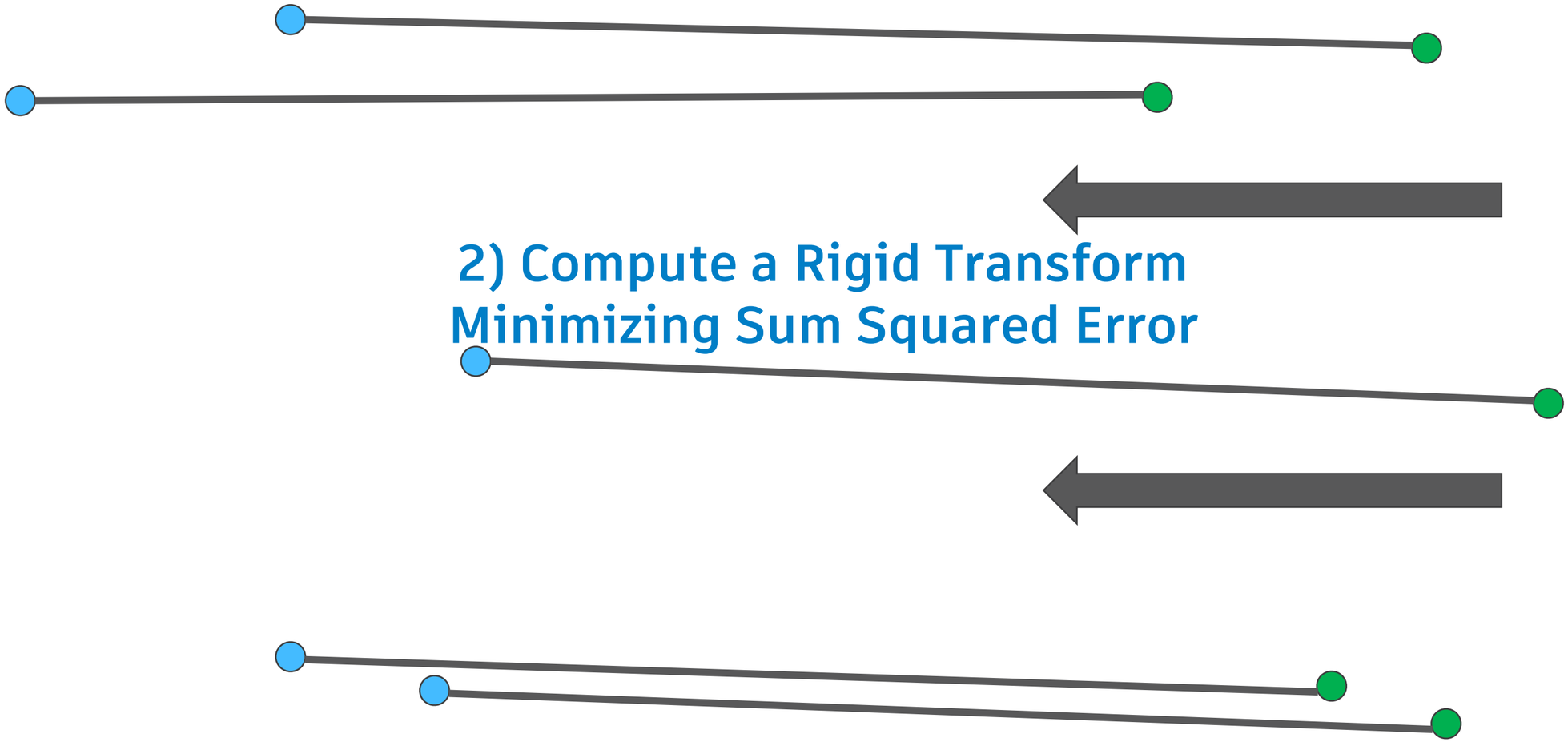
2) Compute a Rigid Transform
Minimizing Sum Squared Error



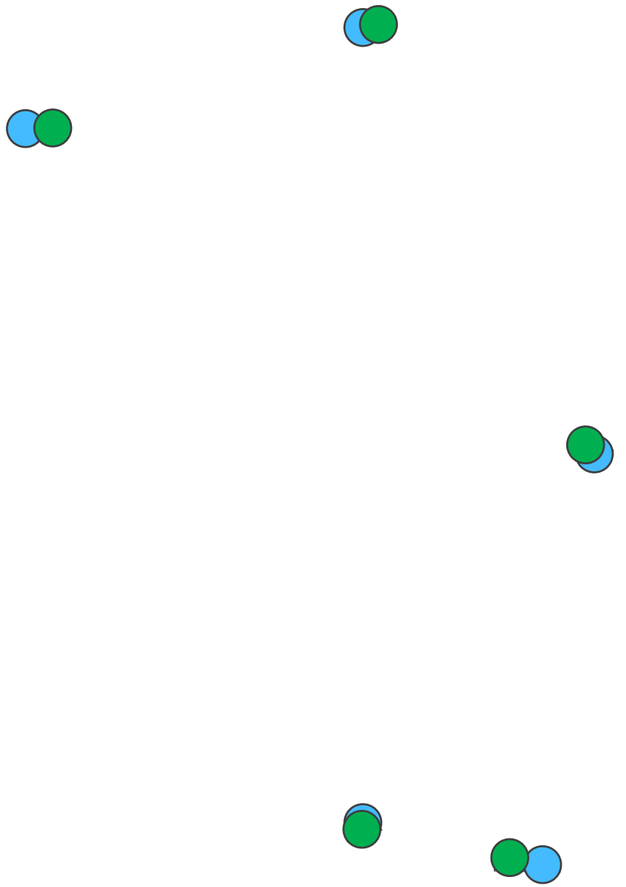
Extracted Targets

Survey Coordinates

Understanding Survey Alignment



Understanding Survey Alignment

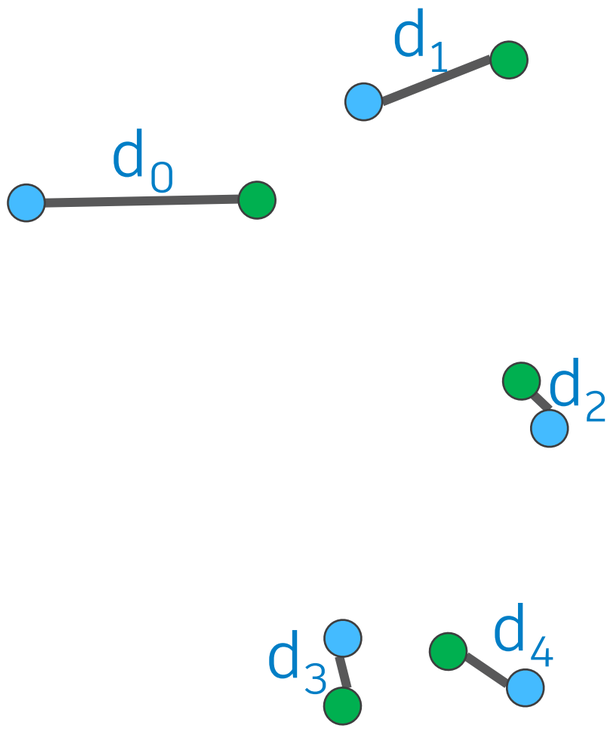


3) Compute Residuals

Extracted Targets
Survey Coordinates

Understanding Survey Alignment

Extracted Targets
Survey Coordinates

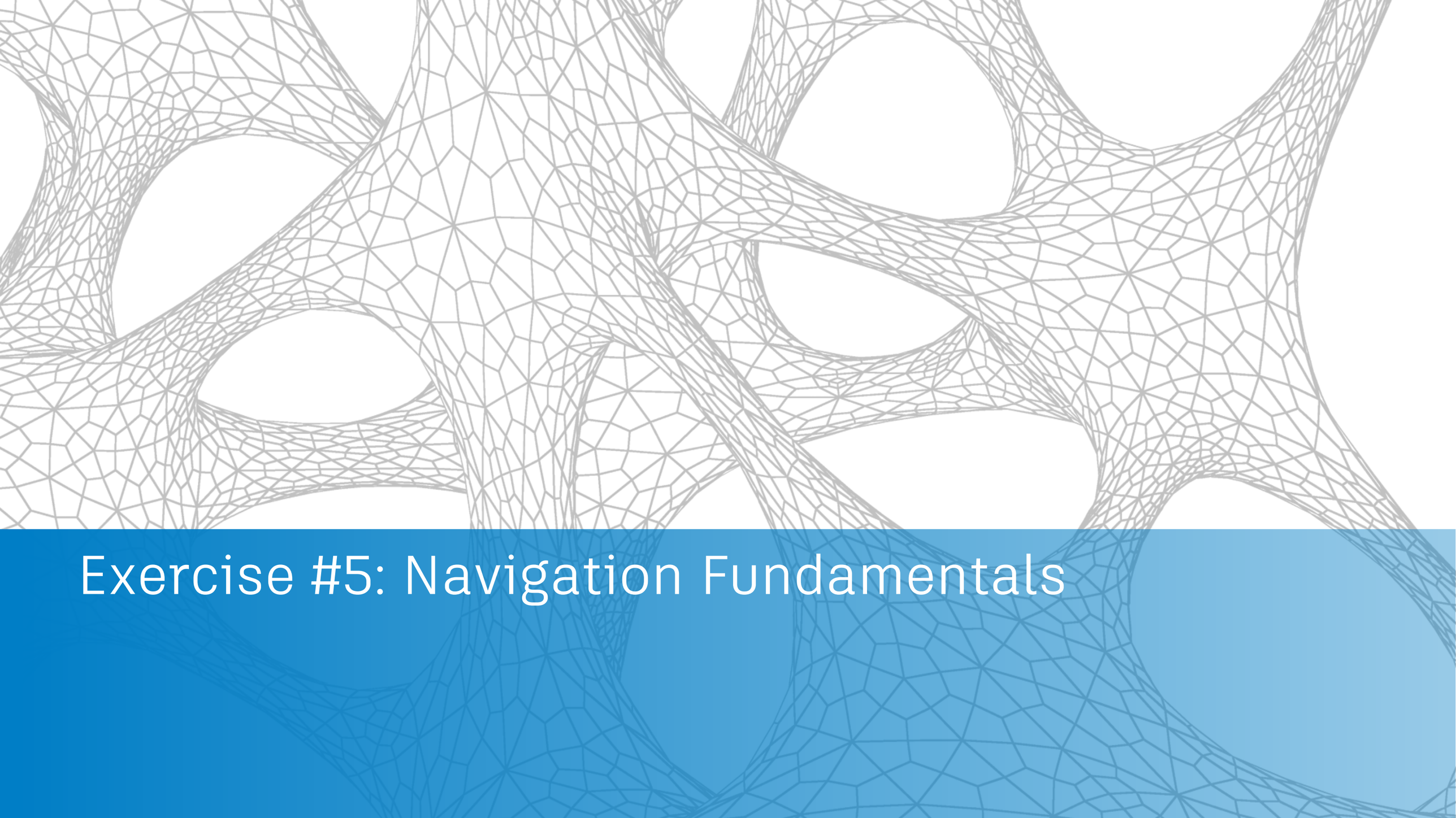


$$\text{Overall RMS} = (d_0^2 + d_1^2 + d_2^2 + d_3^2 + d_4^2)^{1/2}$$

$$\text{Alignment Confidence} = \{d_0, d_1, d_2, d_3, d_4\}$$

Exaggerated Scale

View | Navigate | Edit



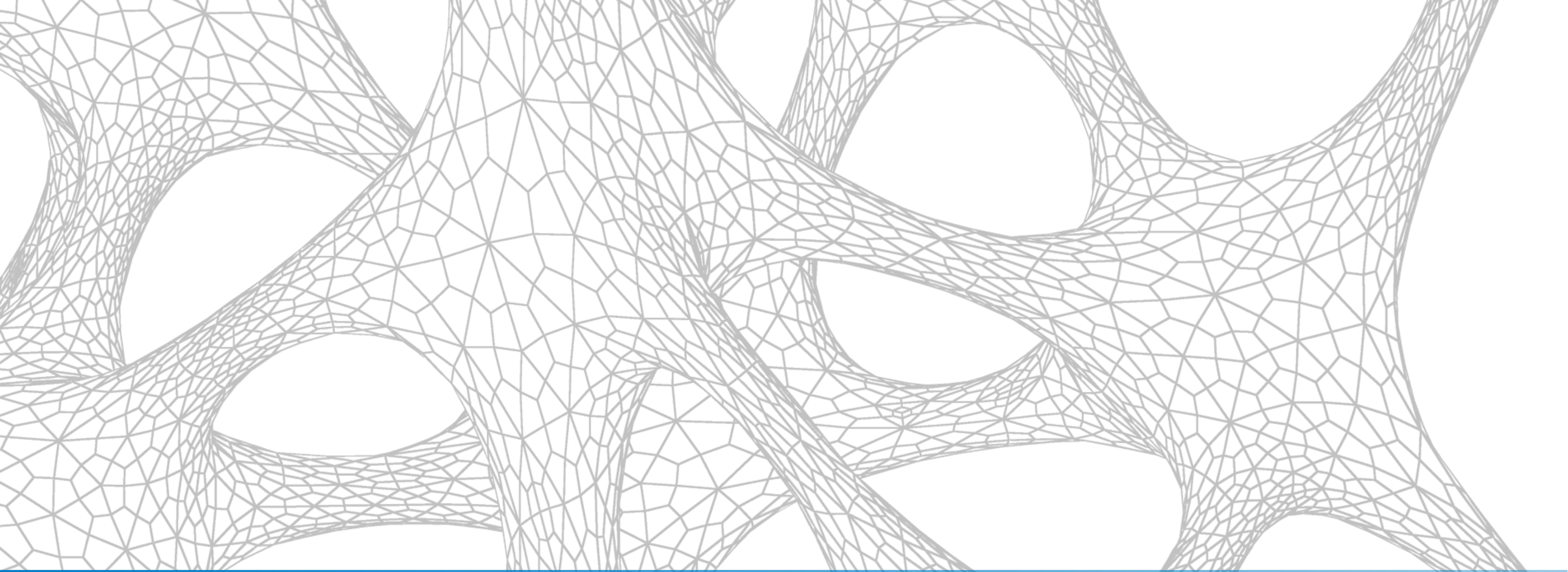
Exercise #5: Navigation Fundamentals

Exercise #6: Tools

Exercise #7: Image Export

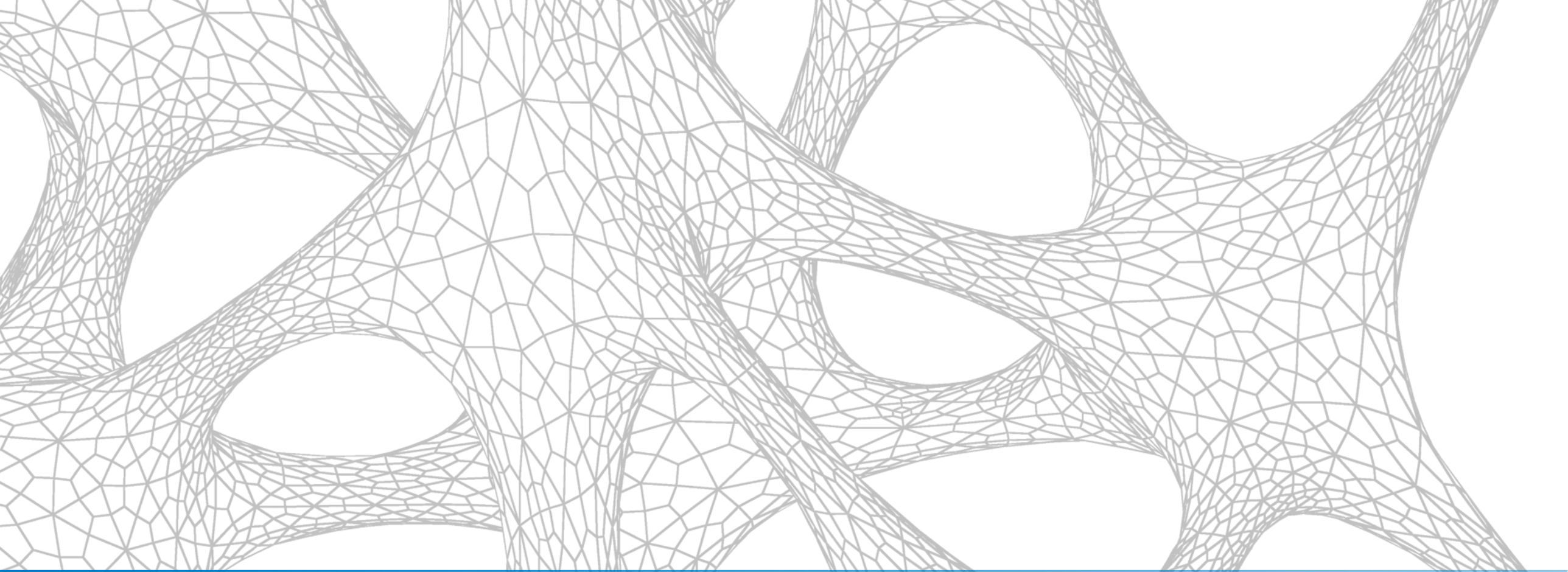
Exercise #8: View States

Video Export



Exercise #9: Basic 3D Flythrough

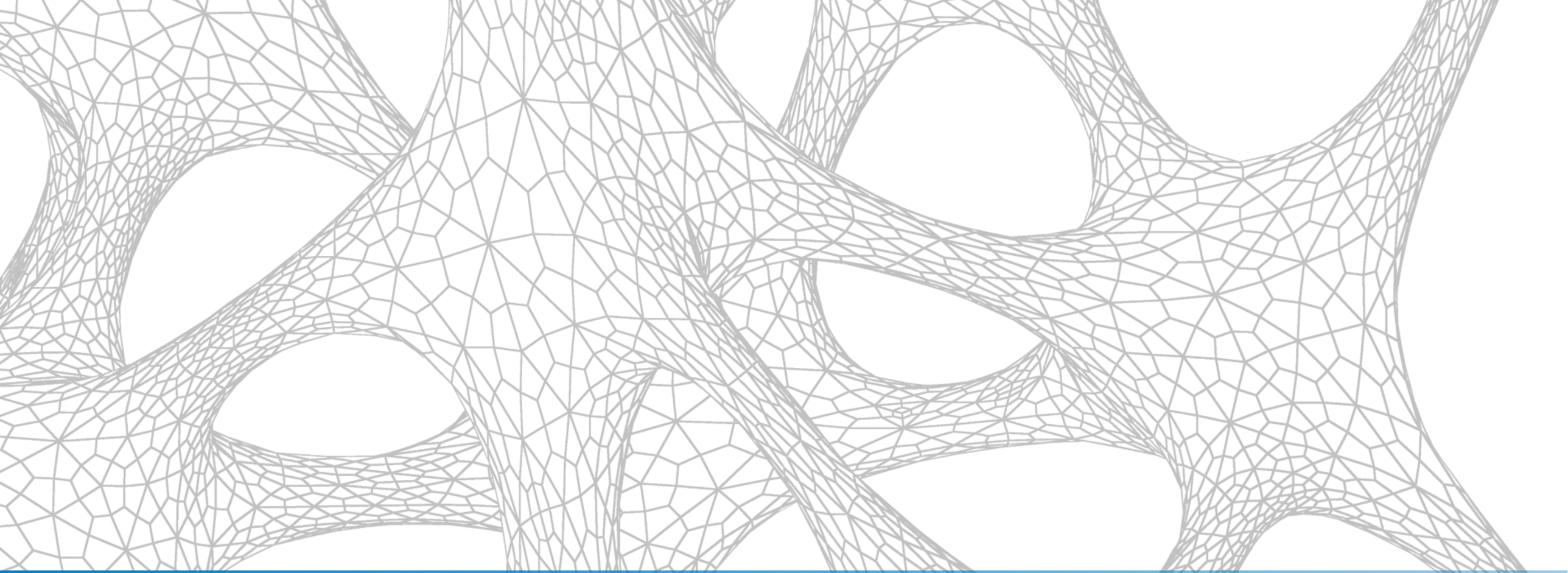
Exercise #10: Story Telling



Exercise #11: Smooth Transitions

Design in Context

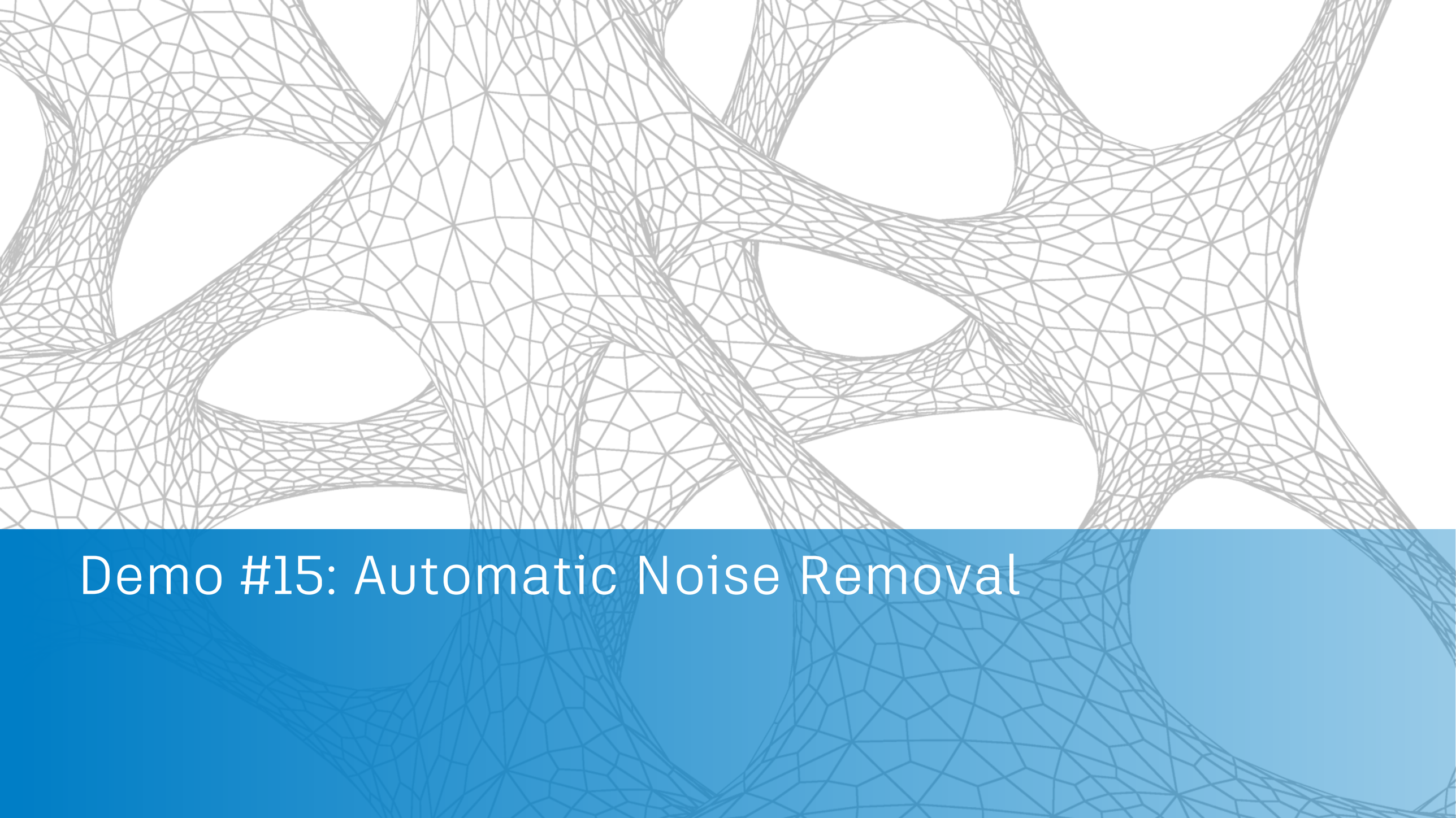
Exercise #12: Render CAD in Photo Real Context



Exercise #13: Create a Textured Mesh From Scans

Managing Scale

Exercise #14: Unified Point Cloud with RealViews



Demo #15: Automatic Noise Removal

Topics for another time …

- Photogrammetry
- Forge Reality Capture API
- Unstructured Scans (Mobile Lidar, Aerial, Handheld)
- Point Clouds in Design Tools (AutoCAD, Revit, Inventor, …)
- Transfer from Mobile
- Region Import
- Annotation Import
- Import Parameters (Format, Filters & Coordinate Systems)
- … and more

ReCap at Autodesk University 2017

- **Reality Capture Forge API Launch Event**
  ~~Monday at 2pm~~
- **ReCap to the Max! How to Edit, Document, and Coordinate - ES125302-L**
  Wednesday 8am
- **Hands On with ReCap Pro from the Field to the Office - CS125189-L**
  Wednesday at 10am
- **ReCap and UAVs to Deliver 2D, 2.5D, and 3D Data for Your AEC and Infrastructure Projects - CS124614-L**
  Thursday at 10am
- User Research
- Idea Exchange
- Answer Bar

Additional ReCap Resources

- Product Page : www.autodesk.com/recap
- Youtube : https://www.youtube.com/user/autodeskrecap
- User Forums

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