Review of Geosetta
1. What is Geosetta?

• Geosetta is a non-profit Maryland based company

• Geosetta is providing a platform for hosting subsurface/geotechnical data from various publicly funded sources throughout the United States.

• Geosetta is developing geospatial and augmented reality visualization tools, with machine learning techniques.

• Geosetta provides a preliminary understanding of the anticipated subsurface conditions at any project site. And is a tool to plan an efficient/focused subsurface exploration program.
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2. Mission

Presenting and deriving valuable deliverables from publicly funded geotechnical data for the benefit of the geotechnical and civil engineering profession.
Data Sources

- Standard Penetration Testing
- Auger Testing
- Foundation Installation

Data Examples

- Soil Strength
- Ground water Level
- Depth to Rock
- Soil Composition
- Rock Composition
- Rock Quality
Existing Data Formats

Government agencies spend millions of dollars performing geotechnical testing for their projects each year. The results of this testing is generally stored in paper logs, or single standalone electronic files.

These datasets are:

- not GIS enabled
- not easily extractable or searchable
- difficult to use and visualize
Geosetta’s Foundation.

- Procedures to automatically extract gINT or diggs datasets into a PostgreSQL database and vice versa. (IE generate gINT or diggs files on demand from the database.)
Geosetta’s Foundation.

- Procedures to automatically extract gINT datasets into an oracle database and vice versa. (IE generate gINT files on demand from the database.)
- Built a Esri agol based tool for the requesting drilling, tracking testing, and displaying historic data.
Geosetta’s Foundation.

- Procedures to automatically extract gINT datasets into an oracle database and vise versa. (i.e., generate gINT files on demand from the database.)
- Built an Esri agol based tool for the requesting drilling, tracking testing, and displaying historic data.
- Developed machine learning methods to train Deep Neural Networks off historic drilling data.

Supervised Learning

Reinforcement Learning
Geosetta’s Foundation.
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Geosetta’s Foundation:

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**Notes:**

- Works for photo and video
- Find present or missing objects for building Inventories
- Identify issues in real time from video
Geosetta’s Foundation.

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Methods

- Yolo Object Recognition
- Supervised Learning

Tasks/Deliverables

- Ball Detection for slope movement
- Object Identification and inventory building (x-lite, signs, striping, etc)
- Pavement thickness prediction (core & construction history)
- SPT testing data prediction (soil type, strength, rock depth, water depth)
- Rainfall Estimates

Actual data

- Grainsize
  - Clay
  - SAND
  - SILT
  - GRAVEL

Model data

- Grainsize

Estimated Values
Geosetta’s Foundation.

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### Training Neural Networks

1. Collect Historic Drilling Data
2. Extract meaningful variables
3. Process variables through a Neural Network*
4. Build tools that utilize the calculated Numerical Model

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*Step 3 is a recursive process where the network geometry is optimized/derived for the dataset.
Geosetta’s Foundation.

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## Supervised Learning

### Pros:
- After training you can immediately quantify the accuracy
- Model is ready to go right after training
- You can turn discrete data sets into continuous data

### Cons:
- Requires very large training sets (transfer learning can help for specific data sets))
- Most of the development time is spent finding and cleaning historic data
- Requires retraining on a routine basis resulting in static models between training sessions
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- Supervised Learning
  - Yolo Object Recognition
    - Ball Detection for slope movement
    - Object Identification and inventory building (zile, signs, striping, etc.)
  - Fast ai Tabular Data (or random forests)
    - Pavement thickness prediction (core & construction history)
    - SPT testing data prediction (soil type, strength, rock depth, water depth)
    - Rainfall Estimates

- Machine Vision
  - General Machine Vision in Python
    - Aran QA/QC (Blurry underexposed, overexposed photos, etc.)

- Reinforcement Learning
  - Finite Markov Decision Processes/Monte Carlo Methods
    - Predictions for small initial datasets that approve overtime
System makes a prediction drilling data and anticipated schedules based on historic data and learns from the result.

Provides customer with a predicted project timeline based on the unique project values. (Project Location, drilling quantity, time of year, recent productivity)

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Reinforcement Learning

Pros:
- Model is trained after each prediction, and does not require scheduled updates
- Works with small datasets that grow overtime
- Best for building predictions for processes that quickly change over time
- Not a black box and is easier to understand and set logical starting values.
- Example: Estimating field testing delivery dates. (quickly changes based on available resources)

Cons:
- Unless logical values are set initially, at the beginning the models will appear unintelligent as training/exploration occurs
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• Developed machine learning methods to train Deep Neural Networks and reinforcement learning off historic drilling data.
• Developed a pipeline to automatically generate point clouds from State DEM data and Satellite Imagery and combine this with machine learning based predictions.
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xyzrgb (point cloud)

Machine Learning xyz(var)

Xyzrgb+Machine Learning xyz(var)

Depth to Refusal
Blow Counts Low to High
Where do we go from here?:

Geosetta is looking for public and private agencies that are interested in partnering.

Please contact us if you are

• A DOT personnel who can streamline the process of making its Geotechnical test data available.
• You are at an agency or company who would value having access to a dedicated custom portal for your exploration data in a GIS tool.

Email us at info@geosetta.com