STRATUM: Corporate Case Study

Gold Modelling with Stratum SATS

August, 2022

STRATUM AI

STUDY CASE
GOLD DEPOSIT

Intrusion-related gold deposit in **northern Kazakhstan**

THE DEPOSIT

- Consists of ~150k meters of drillhole assays, ~40k blasthole assays, ~40k other assays
- Deposit is extremely high nugget with frequent jumps from 0 to 10g/T+ between adjacent assays

STUDY CASE
GOLD DEPOSIT

Intrusion-related gold deposit in **northern Kazakhstan**

PROBLEM

Data is extremely high nugget, sometimes 0g/T occurs in HG zone, sometimes 5g/T in W zone.

OBJECTIVE

Sort real nuggets from HG anomalies

OUTCOME

A more accurate resource model that can predict more in-situ value with greater confidence.

SOLUTION

AI outperforms Kriging by creating an error-tolerant model that can properly leverage the 230k high nugget assays present at the deposit

STUDY CASE
GOLD DEPOSIT

Intrusion-related gold deposit in **northern Kazakhstan**

MAIN OBJECTIVE

Leverage Stratum's SATS AI technology trained on high-nugget assays to create a more accurate gold model to predict more in-situ value with greater confidence.

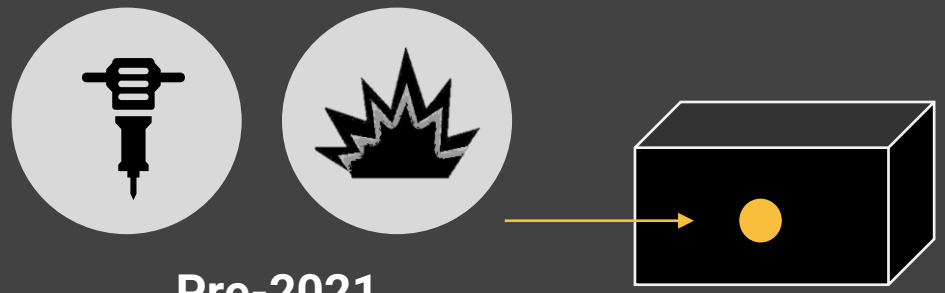
VALUE PREPOSITION

- Improve realized mine plan NPV by better sorting between ore/waste at long-term resource model level.
- Increase in-situ resource by identifying missed mineralization.
- Validate in-situ resource faster and cheaper (less drilling) with AI-guided drilling.

GOLD MODELLING
INPUT DATA

RECONCILIATION TEST SET

Q42021 - Q12022
Blastholes



Pre-2021
Drillholes, Blastholes

Reconciliation Test Set

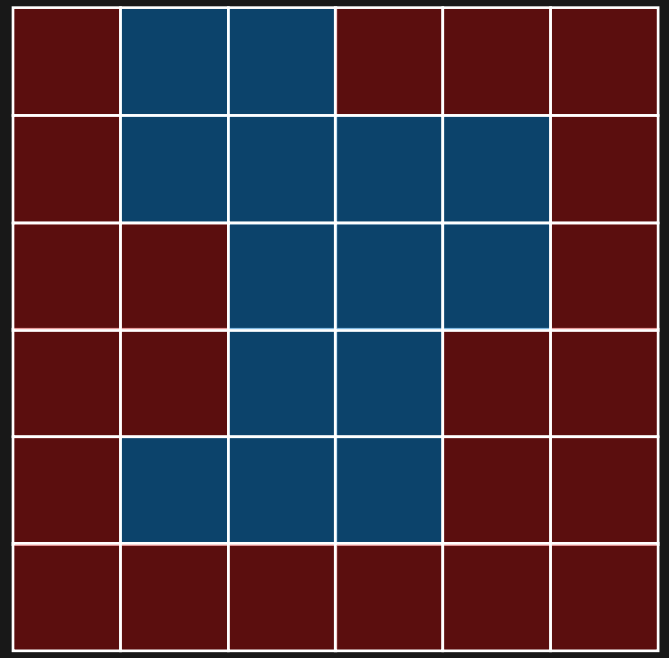
Input Data

GOLD MODELLING
BLOCK LEVEL METRICS

EVALUATION METRICS

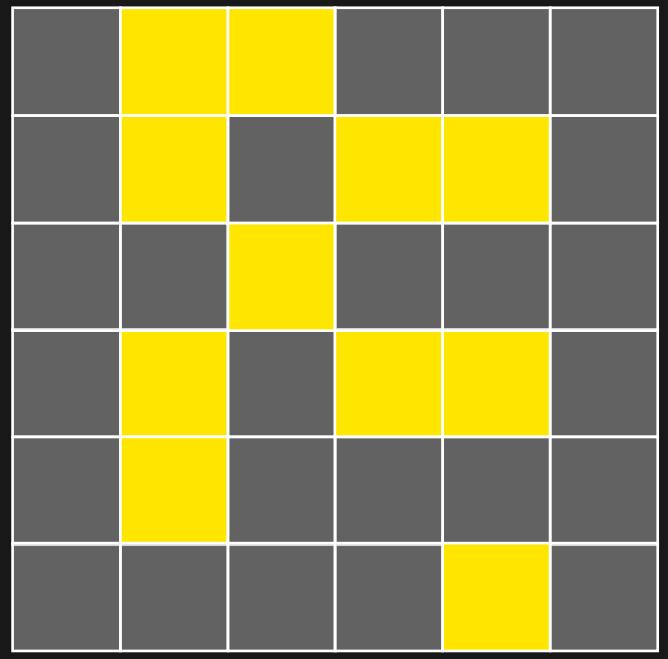
Model Prediction

Ore Waste



Ground Truth

Ore Waste



RECALL:

It allows to compare the % of true HG classified as such per the models. (Find all the ore that exists)

$$\frac{\sum TP}{\sum (TP + FN)}$$

PRECISION:

It allows to compare the ability of the models to identify HG and reduce false positives.

$$\frac{\sum TP}{\sum (TP + FP)}$$

Economic Tonnage Deviation (ETD):

Economic Tonnage (ET): above cut-off grade

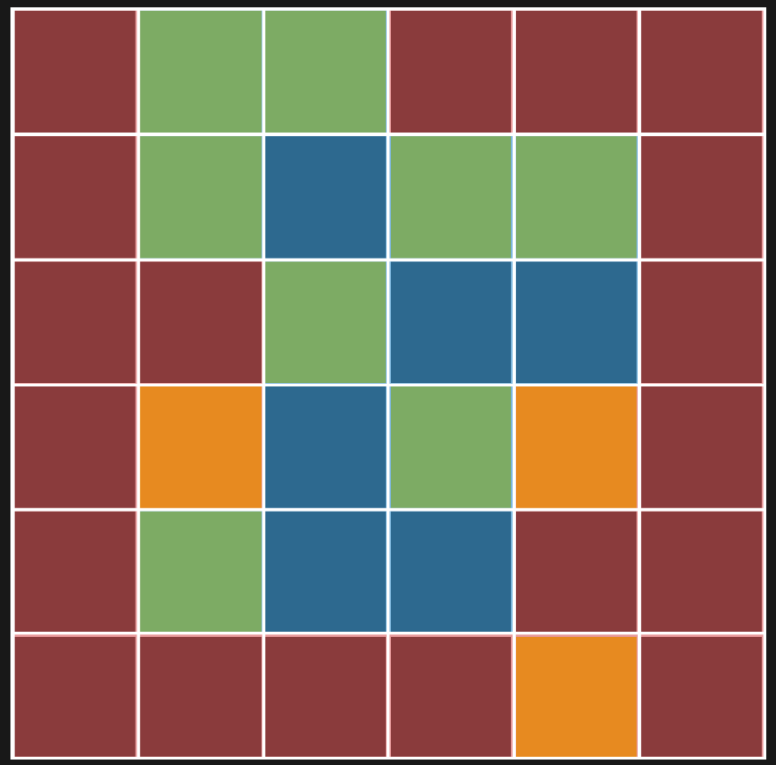
$$\sum \frac{ET\ Predicted - ET\ Ore\ Control}{ET\ Ore\ Control}$$

Cut-off grade : 0.3 g/T

GOLD MODELLING
BLOCK LEVEL METRICS

EVALUATION METRICS

Block Reconciliation



TP: True Positive
HG predicted as HG

FP: False Positive
LG predicted as HG

TN: True Negative
LG predicted as LG

FN: False Negative
HG predicted as LG

** High Grade (HG) = grade > cut-off / Low Grade (LG) = grade < cut-off*

RECALL:

It allows to compare the % of true HG classified as such per the models. (Find all the ore that exists)

$$\frac{\sum TP}{\sum(TP + FN)}$$

PRECISION:

It allows to compare the ability of the models to identify HG and reduce false positives.

$$\frac{\sum TP}{\sum(TP + FP)}$$

Economic Tonnage Deviation (ETD):

Economic Tonnage (ET): above cut-off grade

$$\sum \frac{ET\ Predicted - ET\ Ore\ Control}{ET\ Ore\ Control}$$

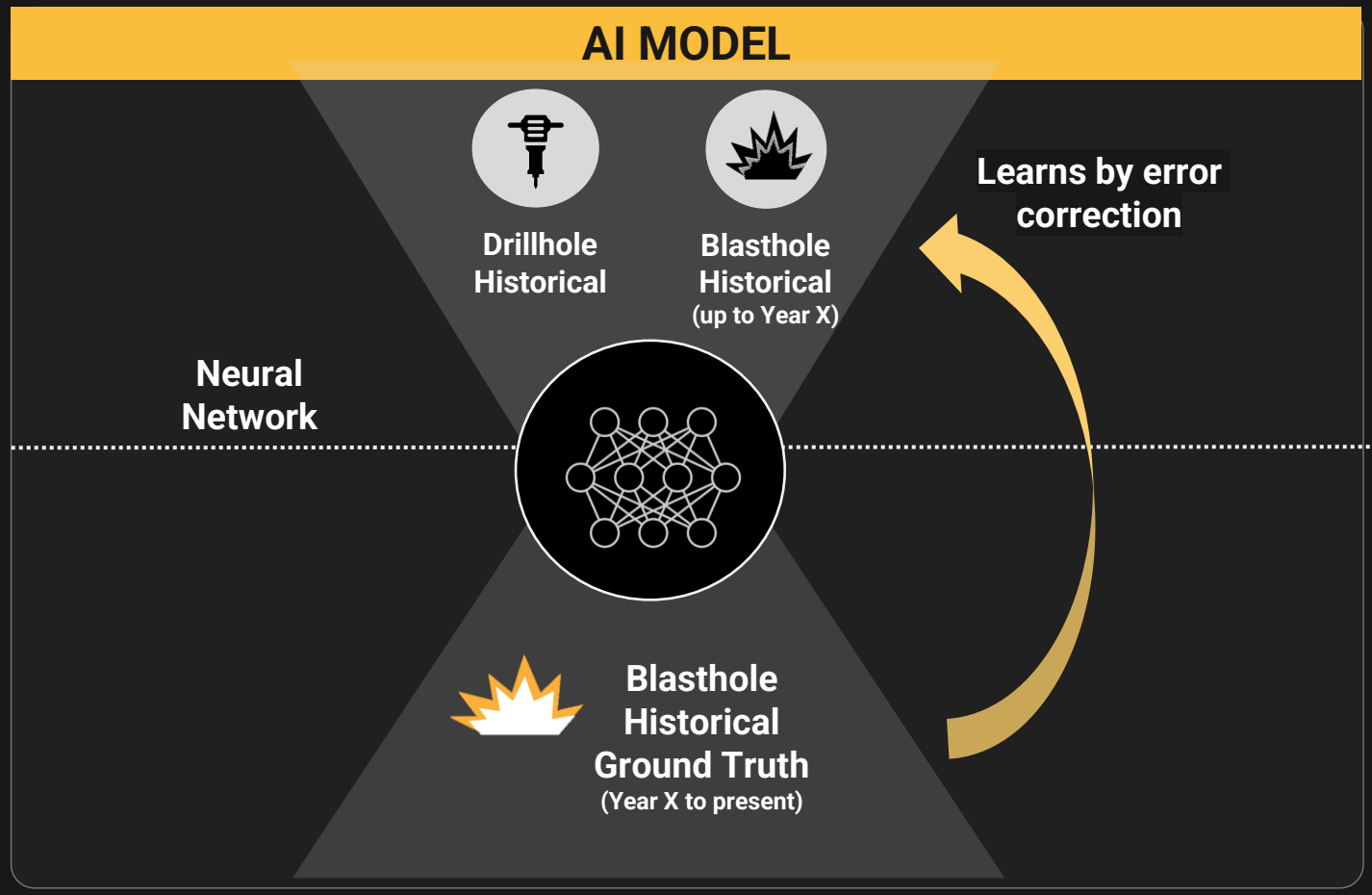
Cut-off grade : 0.3 g/T

AI vs Kriging

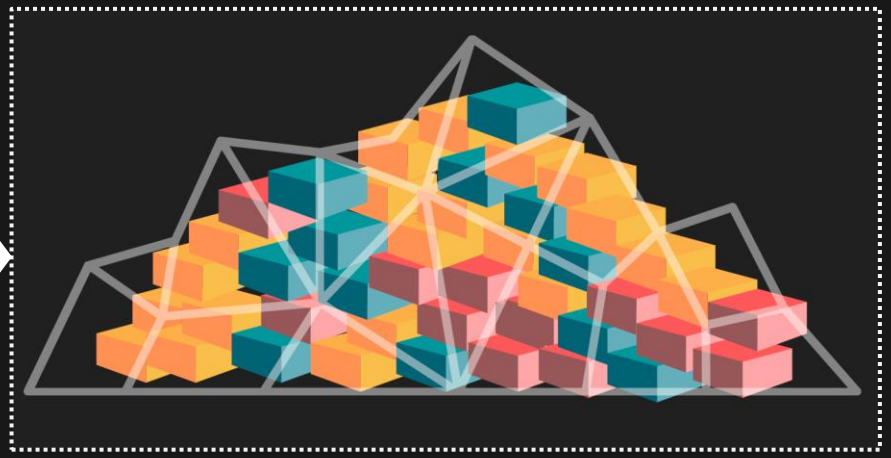
F1 Reconciliation (Long-Term Model vs Blastholes)

STRATUM MODELS
AI MODEL STRUCTURE

BASELINE AI MODEL - EXAMPLE

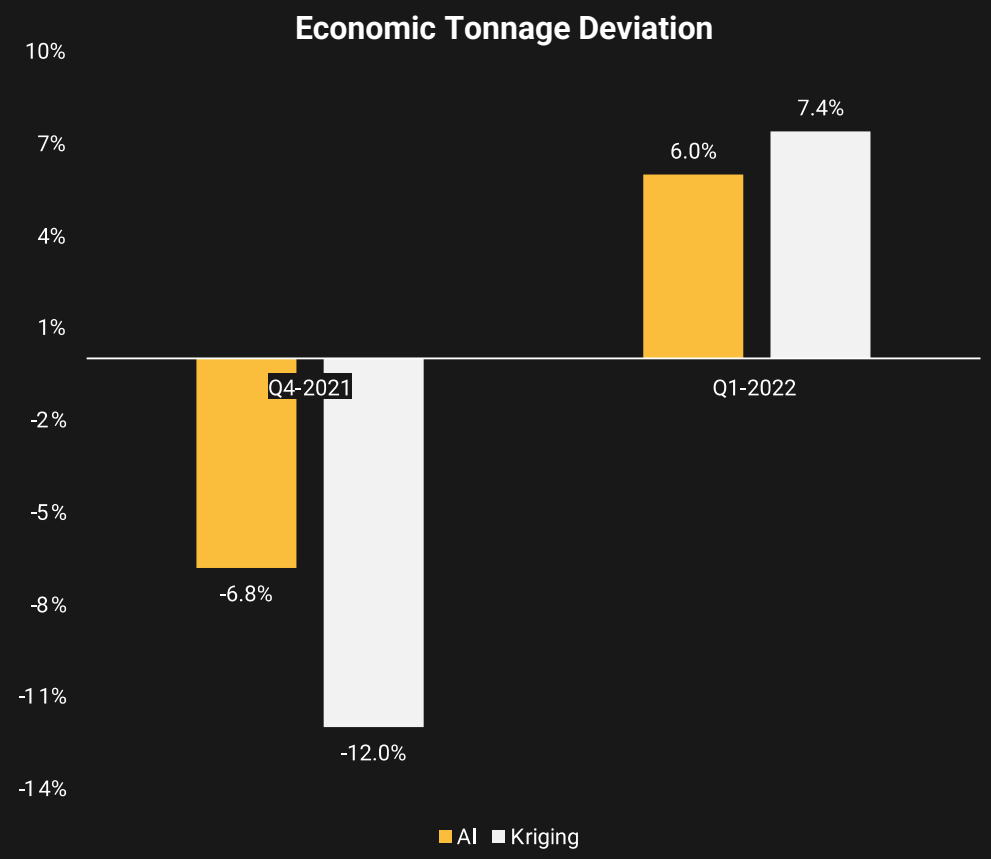


Prediction: Block Model



The model uses **Deep Learning** to learn geological patterns that cause grade variation and generates a block model for any element in the deposit.

GOLD MODELLING
F1 RECONCILIATION



Note: Last 2 weeks of December are included as part of Q1-2022 due to dating ambiguity

ECONOMIC TONNAGE RESULTS

Stratum's AI resource model more accurately classifies whether a block is economical to extract.

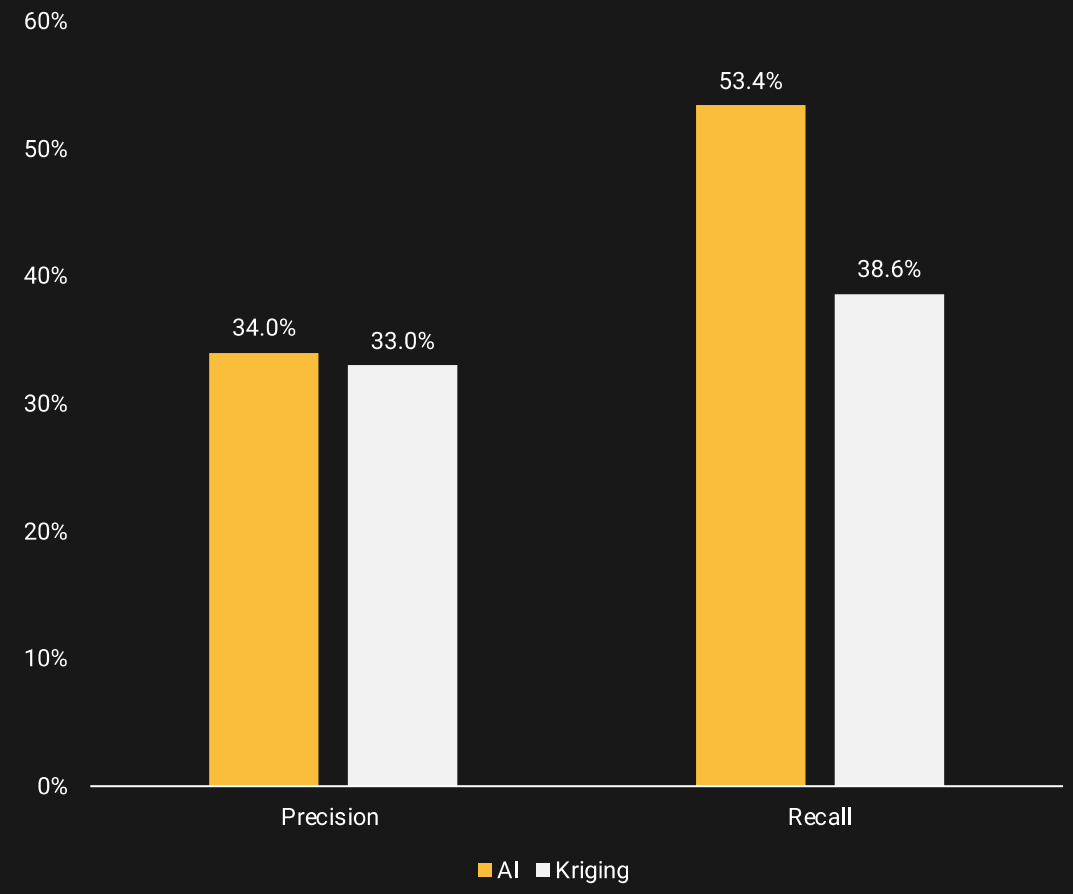
Economic Tonnage Deviation (ETD):

- The graph shows the ETD for the AI model and the Kriging model for the quarters of Q4-2021 and Q1-2022.

Results:

- AI has 43% less economic tonnage deviation than Kriging in Q4-2021
- AI has 19% less economic tonnage deviation than Kriging in Q1-2022

GOLD MODELLING
F1 RECONCILIATION



Note: Last 2 weeks of December are included as part of Q1-2022 due to dating ambiguity

ECONOMIC REGION CLASSIFICATION
Q4 2021

Cut-off grade : 0.3 g/T

Stratum's model more accurately predicts the grade of any block.

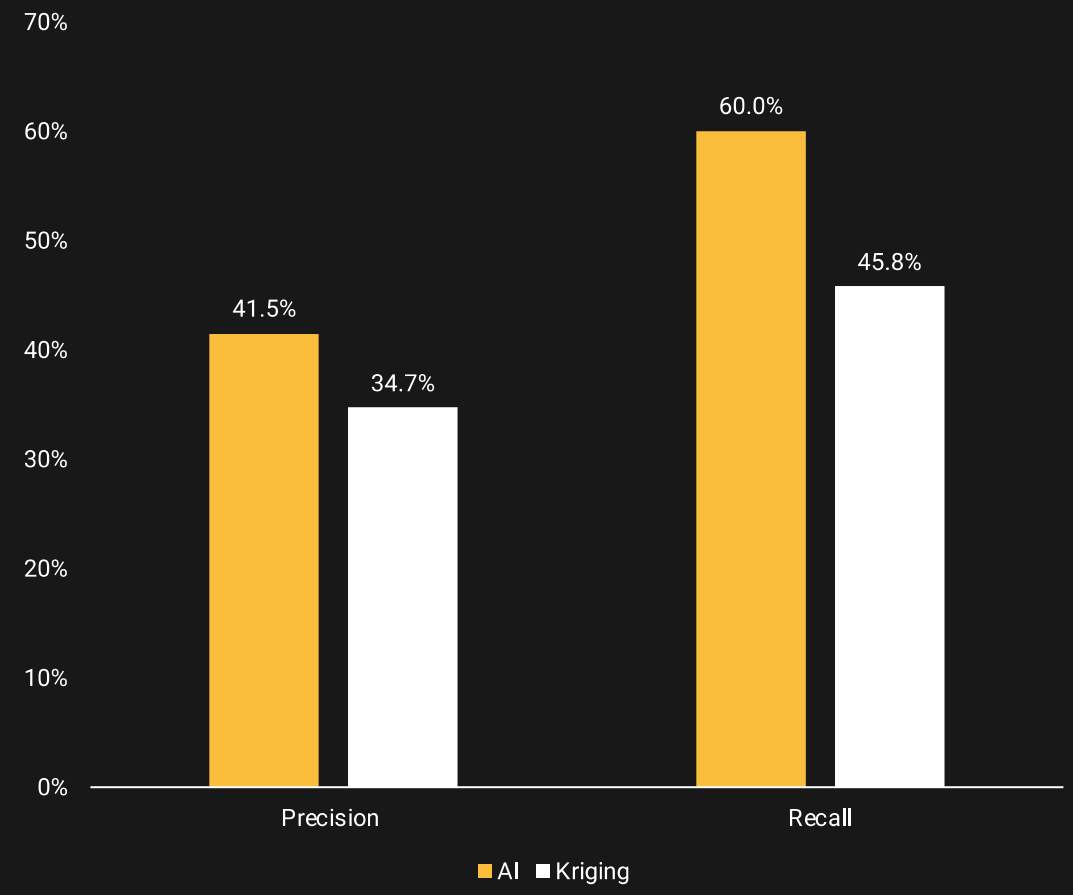
Metrics

- **Recall** is what percent of economic blastholes are classified as such
  (Find all gold that exists)
- **Precision** is what percent of blastholes classified as "economic" are in fact so
  (Minimal false positives)

Results

- 3.0% higher precision over Kriging
- 38.3% higher recall over Kriging

GOLD MODELLING
F1 RECONCILIATION



Note: Last 2 weeks of December are included as part of Q1-2022 due to dating ambiguity

ECONOMIC REGION CLASSIFICATION
Q1 2022

Cut-off grade : 0.3 g/T

Stratum's model more accurately predicts the grade of any block.

Metrics

- **Recall** is what percent of economic blastholes are classified as such
  (Find all gold that exists)
- **Precision** is what percent of blastholes classified as "economic" are in fact so
  (Minimal false positives)

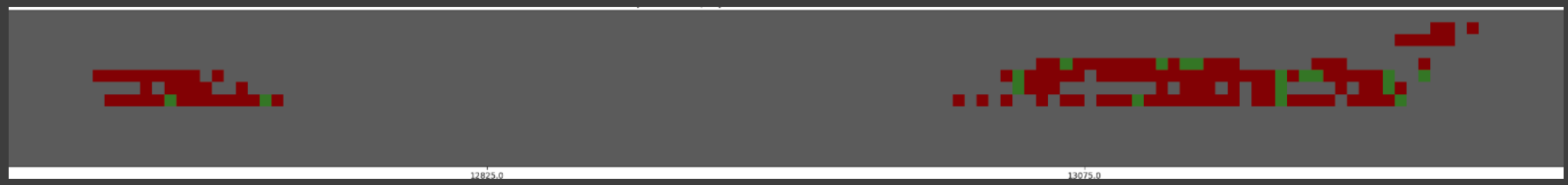
Results

- 19.6% higher precision over Kriging
- 31.0% higher recall over Kriging

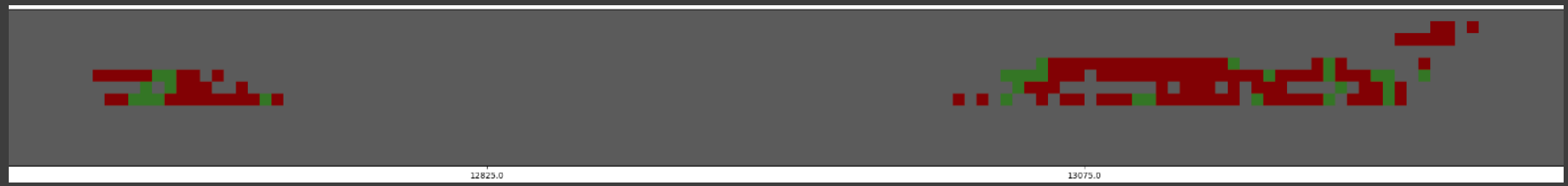
GOLD MODELLING
CROSS SECTION ANALYSIS

CROSS SECTION
Y = 13450

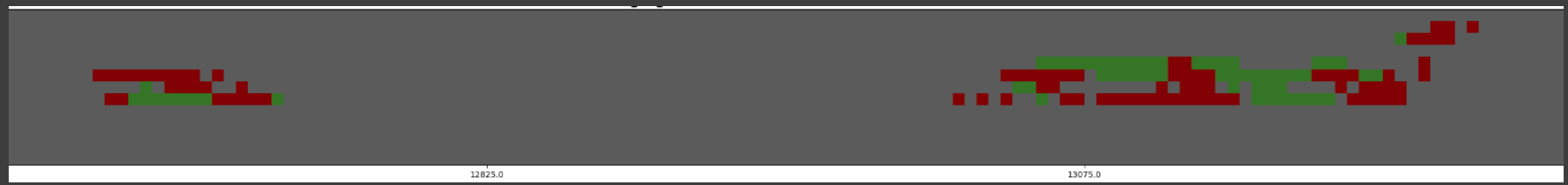
Blastholes
(2021Q4-2022Q1)

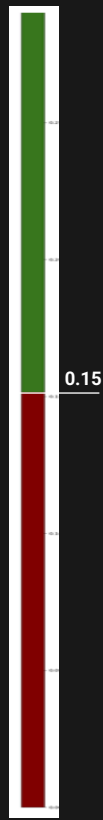


AI 2021



Kriging 2021



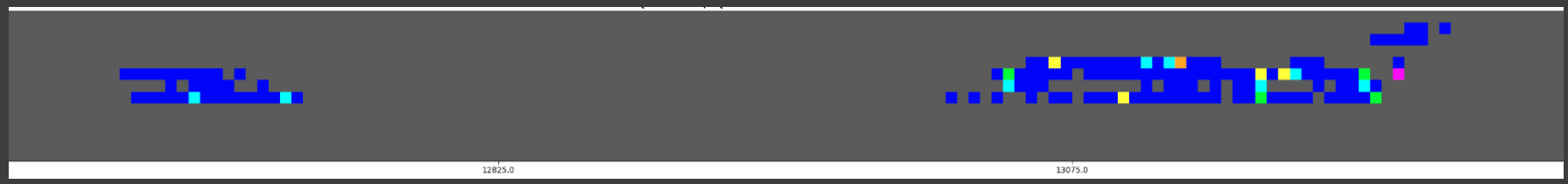


Comments: AI correctly identifies area with little economic resource where Kriging expects economic gold.

GOLD MODELLING
CROSS SECTION ANALYSIS

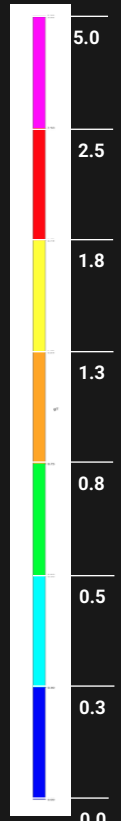
CROSS SECTION
Y = 13450

Blastholes
(2021Q4-2022Q1)



AI 2021

Kriging 2021

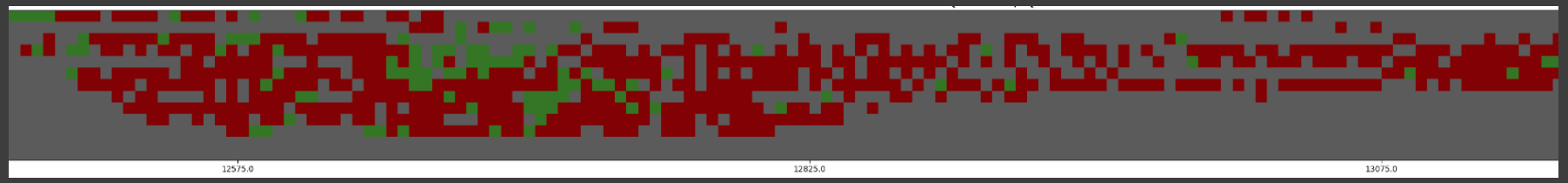


Comments: AI correctly identifies area with little economic resource where Kriging expects economic gold.

GOLD MODELLING
CROSS SECTION ANALYSIS

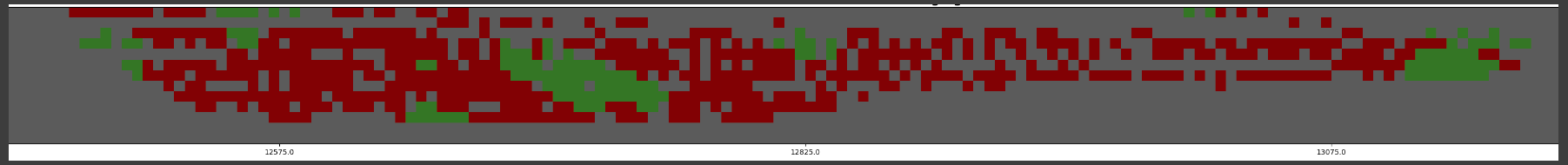
CROSS SECTION
Y = 13655

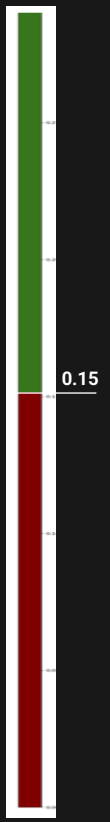
Blastholes
(2021Q4-2022Q1)



AI 2021

Kriging 2021



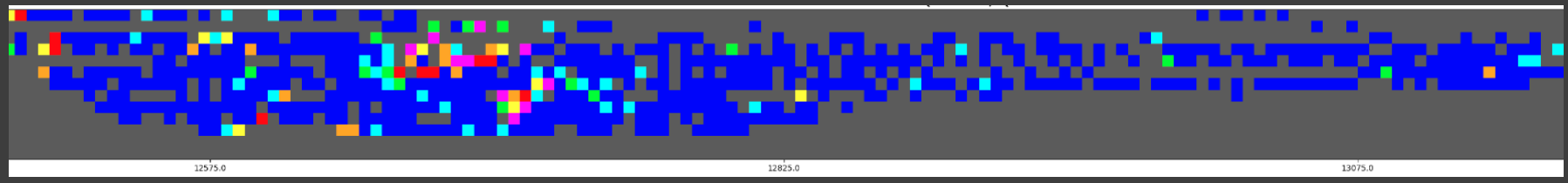


Comments: AI correctly identifies distribution of economic gold while Kriging has many false positives.

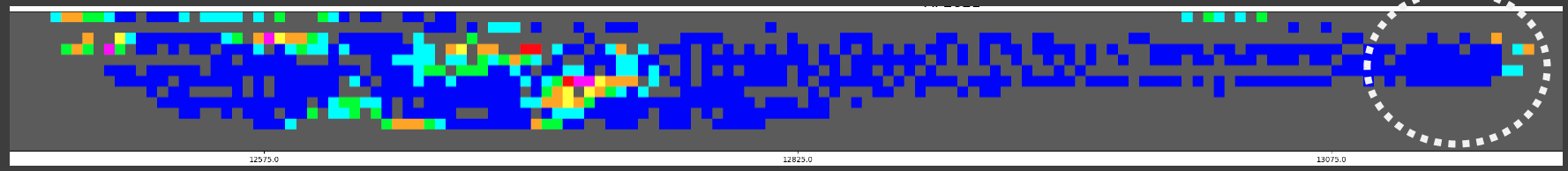
GOLD MODELLING
CROSS SECTION ANALYSIS

CROSS SECTION
Y = 13655

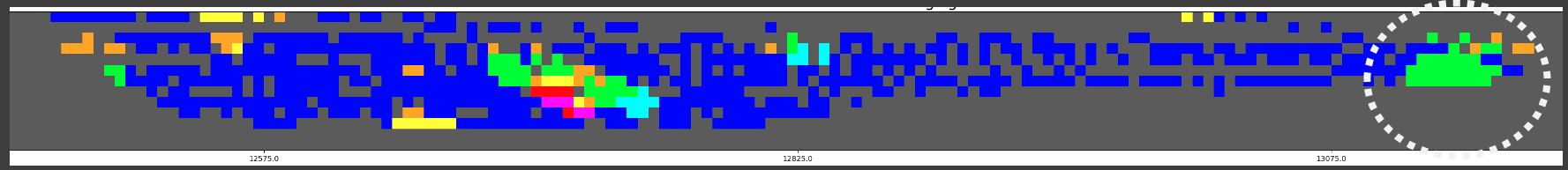
Blastholes
(2021Q4-2022Q1)

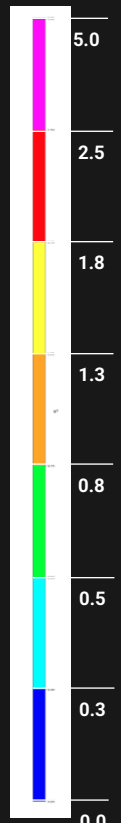


AI 2021



Kriging 2021



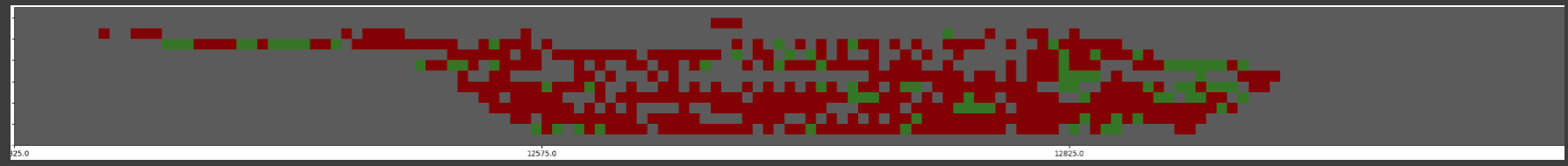


Comments: AI correctly identifies area with little economic resource where Kriging expects economic gold.

GOLD MODELLING
CROSS SECTION ANALYSIS

CROSS SECTION
Y = 13920

Blastholes
(2021Q4-2022Q1)



AI 2021

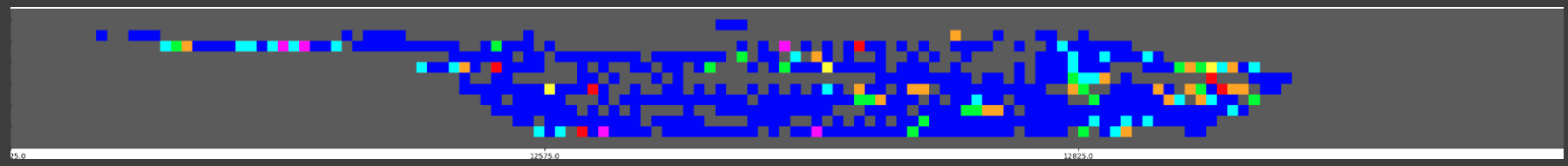
Kriging 2021

Comments: AI correctly identifies economic zone on right while Kriging incorrectly identifies economic zone on left.

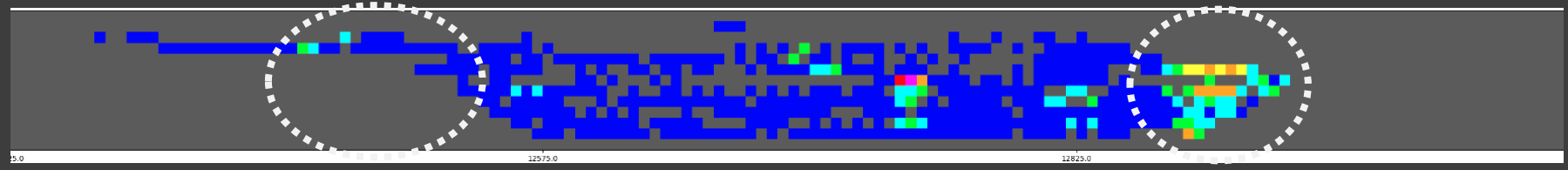
GOLD MODELLING
CROSS SECTION ANALYSIS

CROSS SECTION
Y = 13920

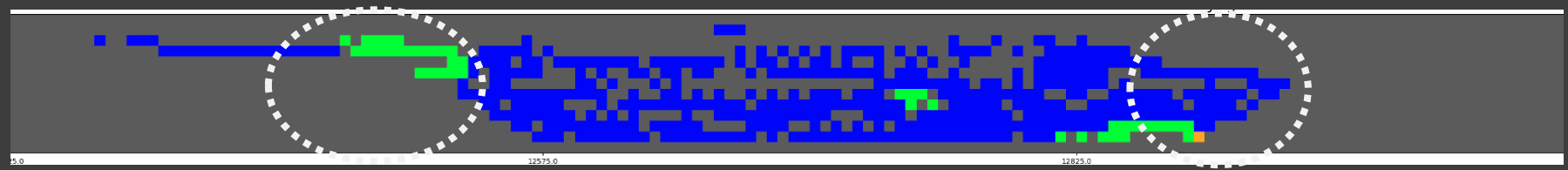
Blastholes
(2021Q4-2022Q1)

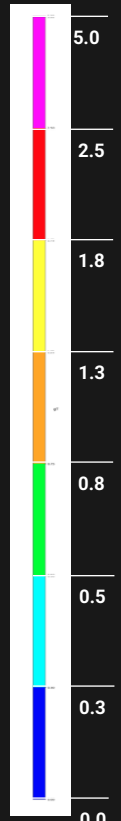


AI 2021



Kriging 2021



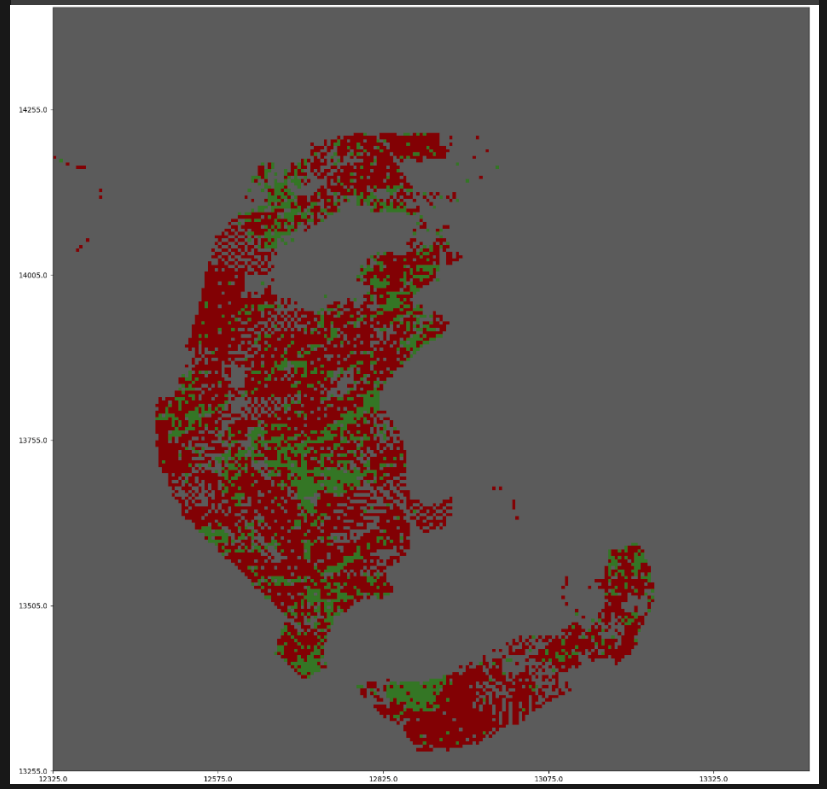


Comments: AI correctly identifies economic zone on right while Kriging incorrectly identifies economic zone on left.

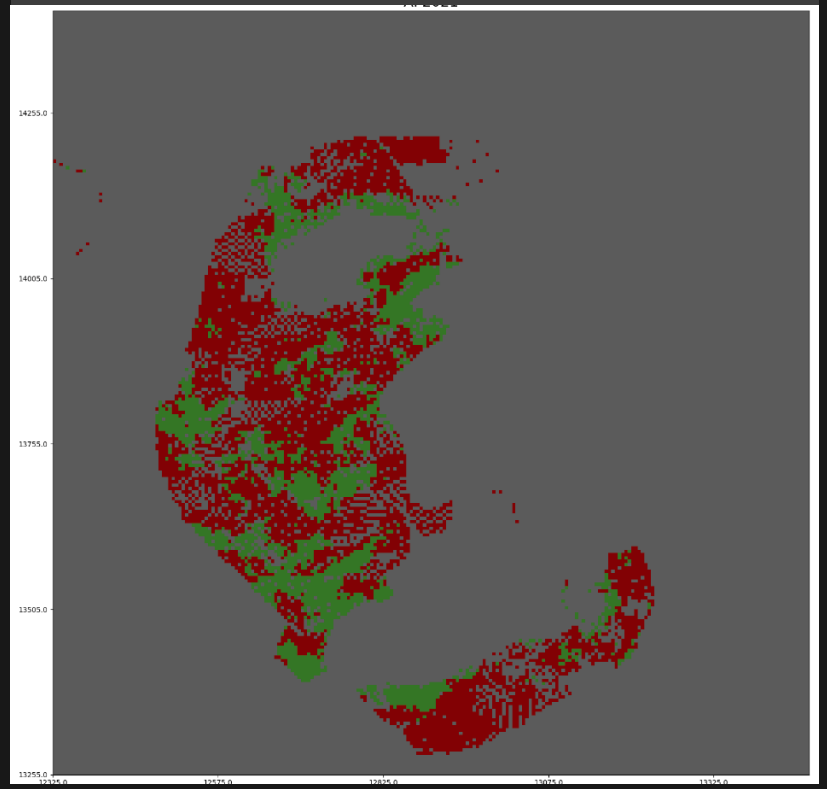
GOLD MODELLING
CROSS SECTION ANALYSIS

CROSS SECTION
Z = 240

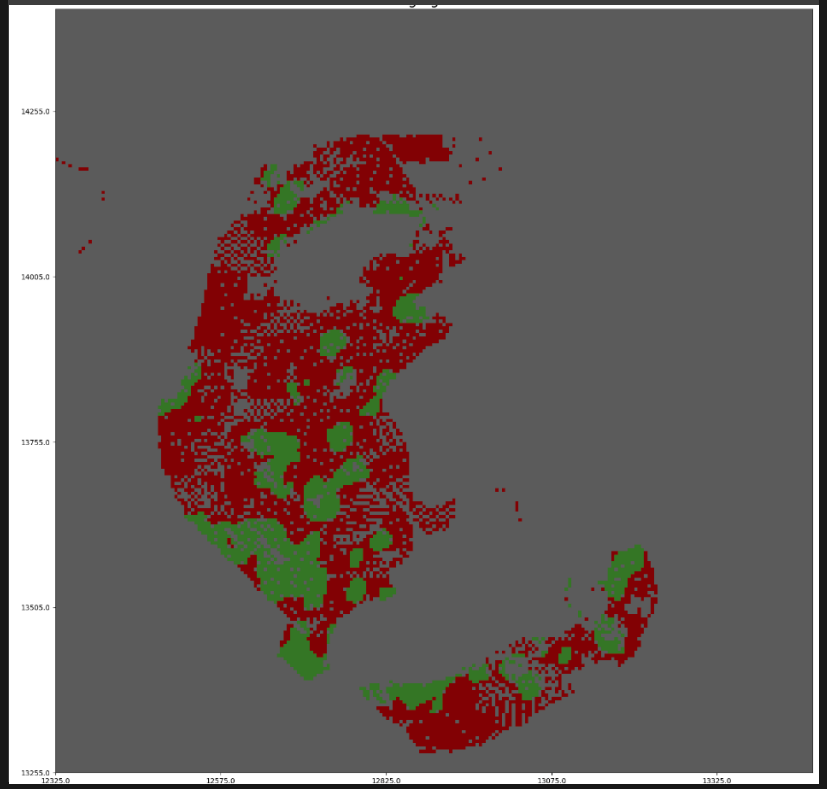
Blastholes (2021Q4-2022Q1)



AI 2021



Kriging 2021

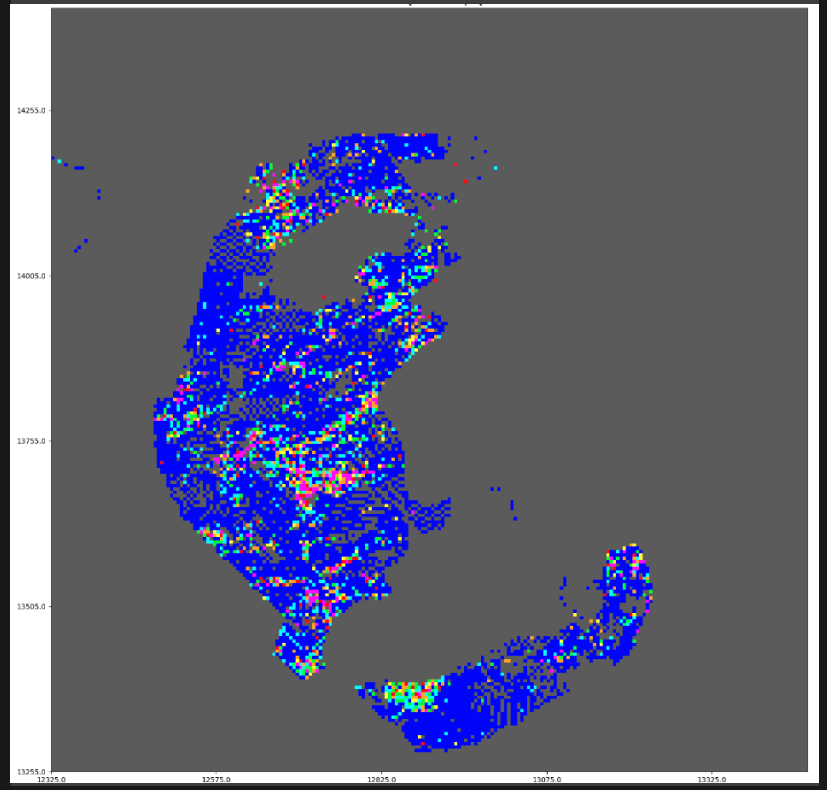


Comments: AI mineralization structure resembles ground truth closer than Kriging.

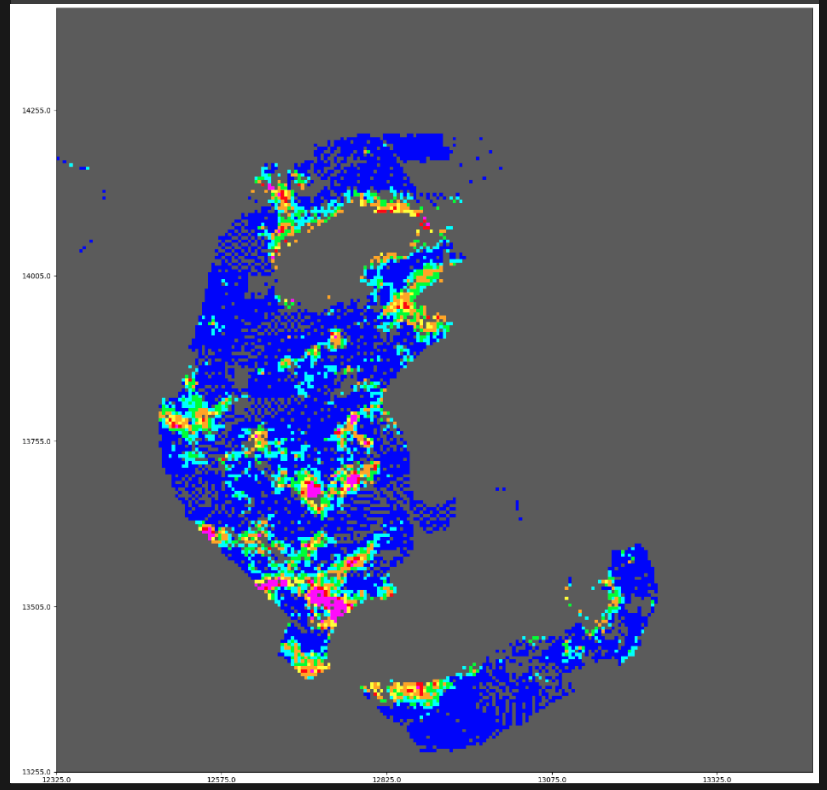
GOLD MODELLING
CROSS SECTION ANALYSIS

CROSS SECTION
Z = 240

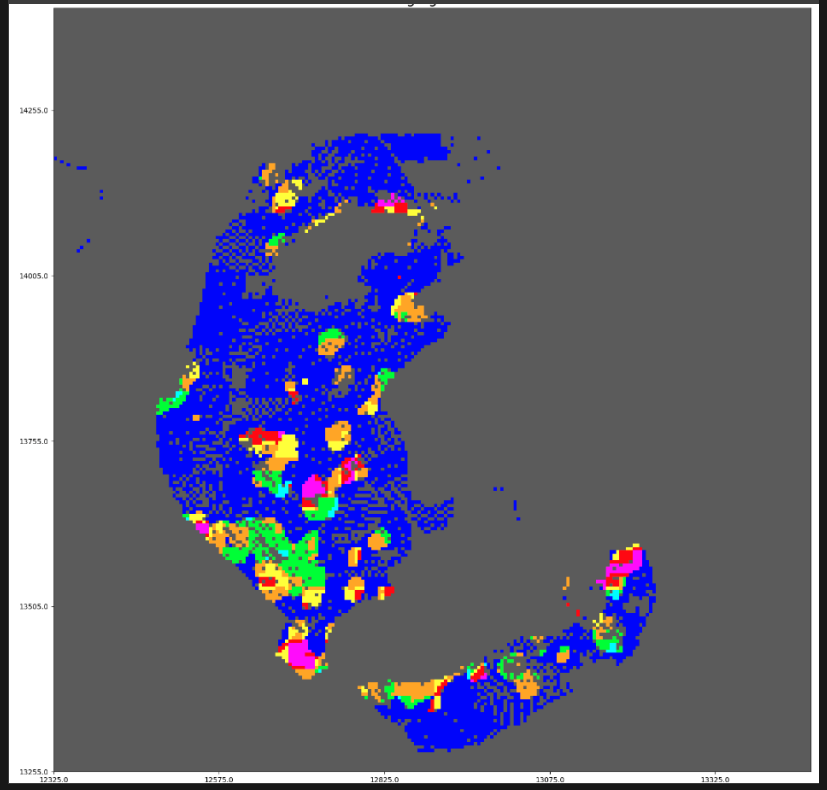
Blastholes (2021Q4-2022Q1)



AI 2021



Kriging 2021

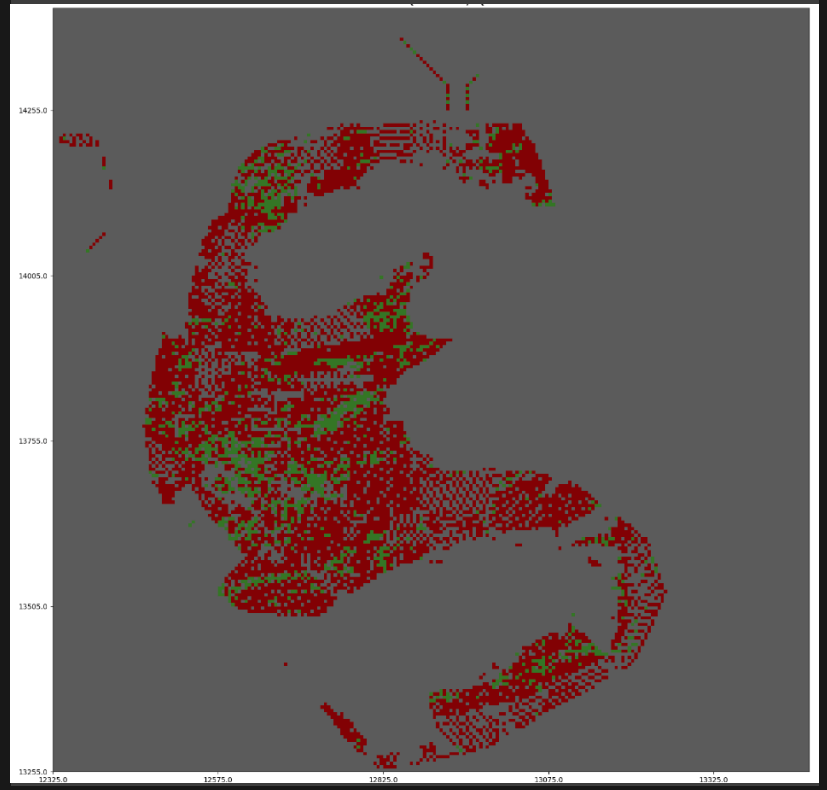


Comments: AI mineralization structure resembles ground truth closer than Kriging.

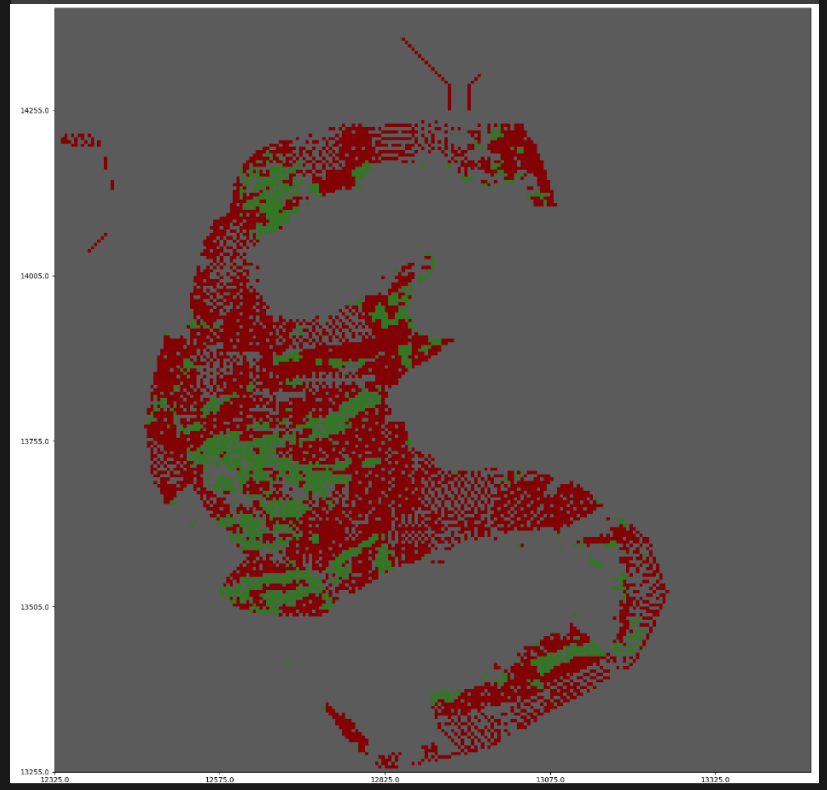
GOLD MODELLING
CROSS SECTION ANALYSIS

CROSS SECTION
Z = 255

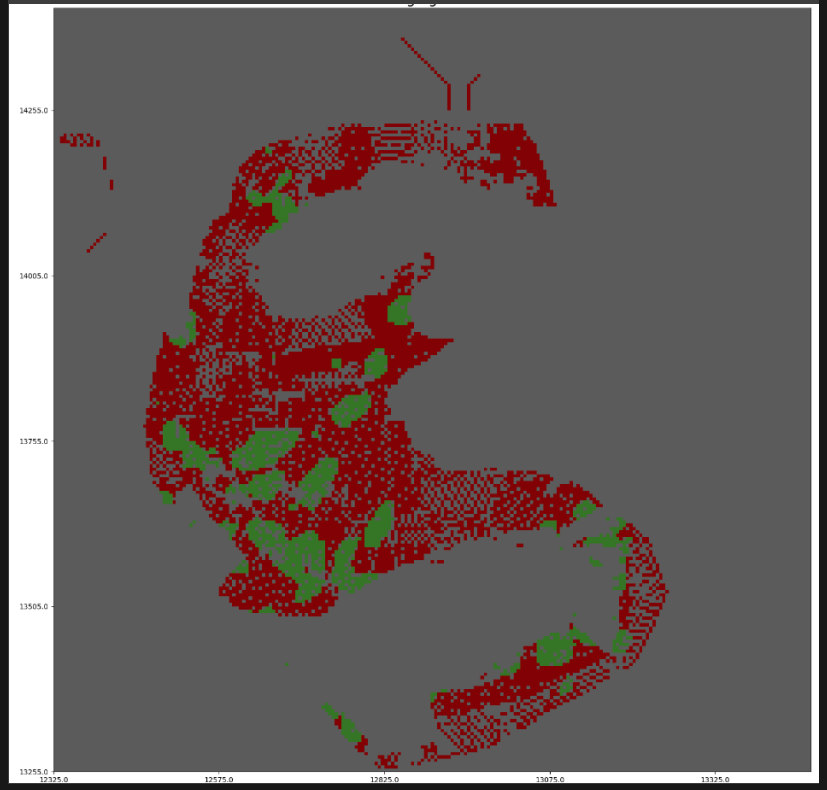
Blastholes (2021Q4-2022Q1)



AI 2021



Kriging 2021

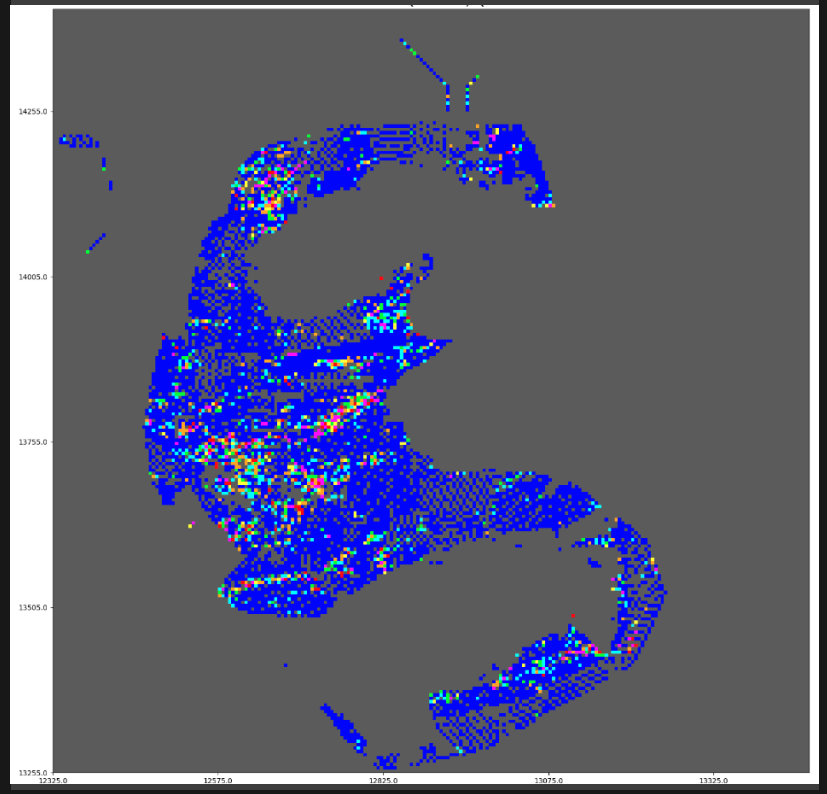


Comments: AI mineralization structure resembles ground truth closer than Kriging.

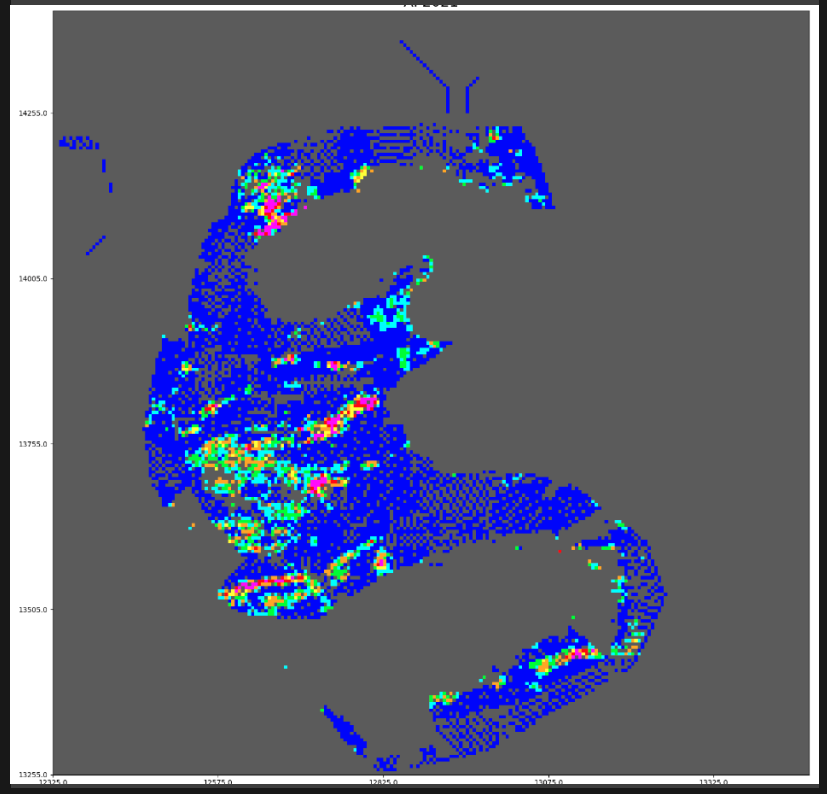
GOLD MODELLING
CROSS SECTION ANALYSIS

CROSS SECTION
Z = 255

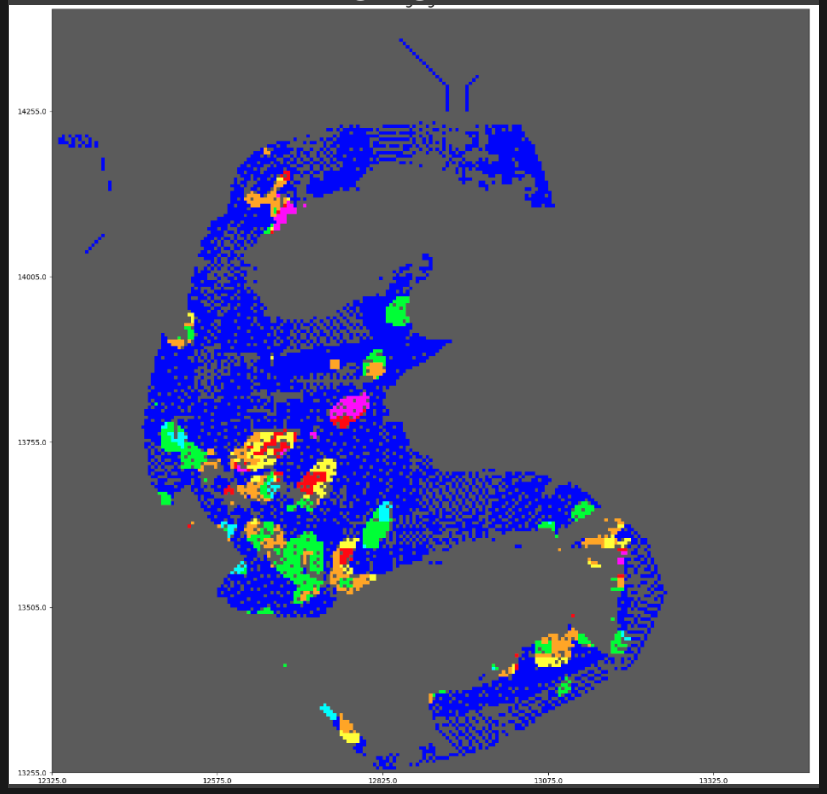
Blastholes (2021Q4-2022Q1)



AI 2021



Kriging 2021

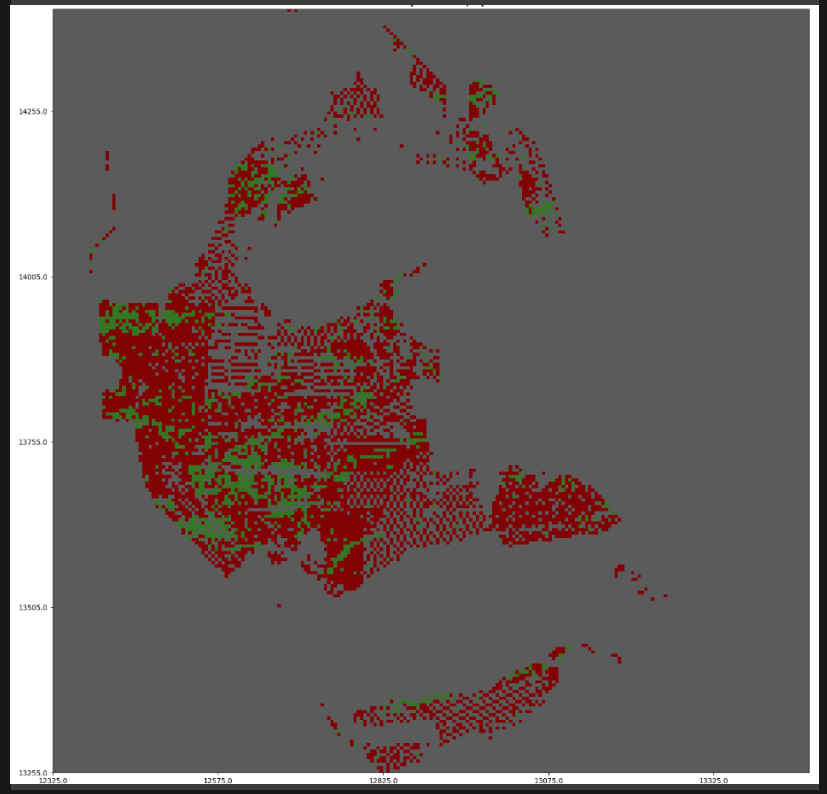


Comments: AI mineralization structure resembles ground truth closer than Kriging.

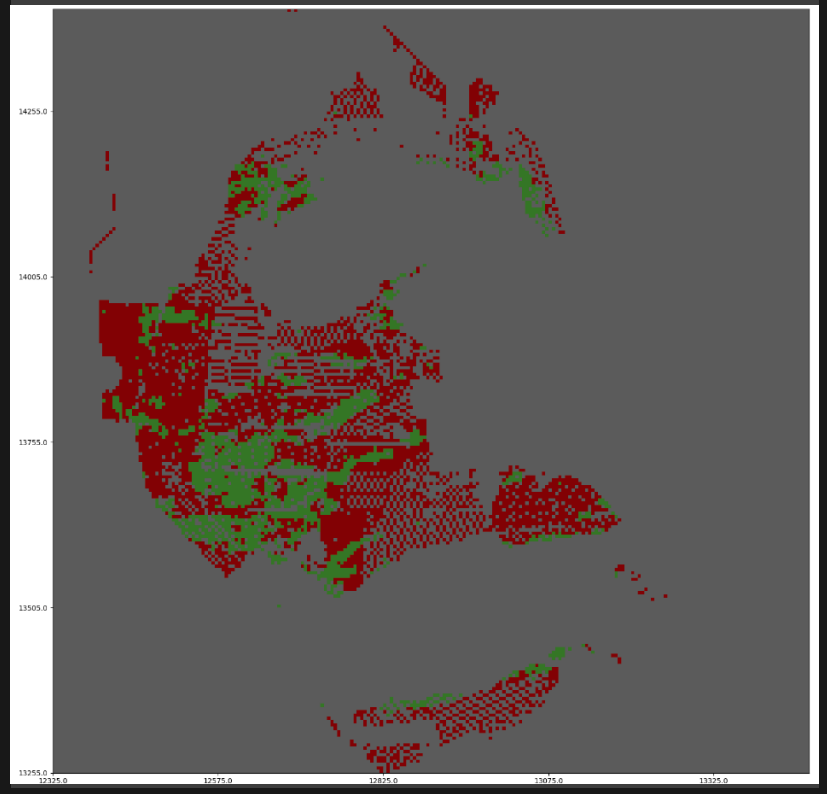
GOLD MODELLING
CROSS SECTION ANALYSIS

CROSS SECTION
Z = 260

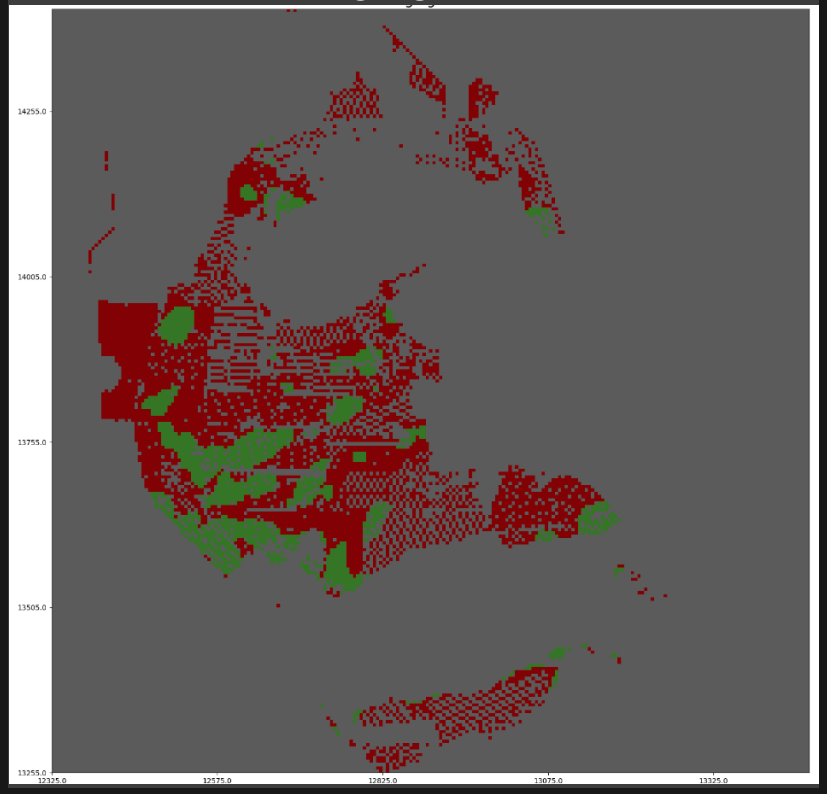
Blastholes (2021Q4-2022Q1)



AI 2021



Kriging 2021

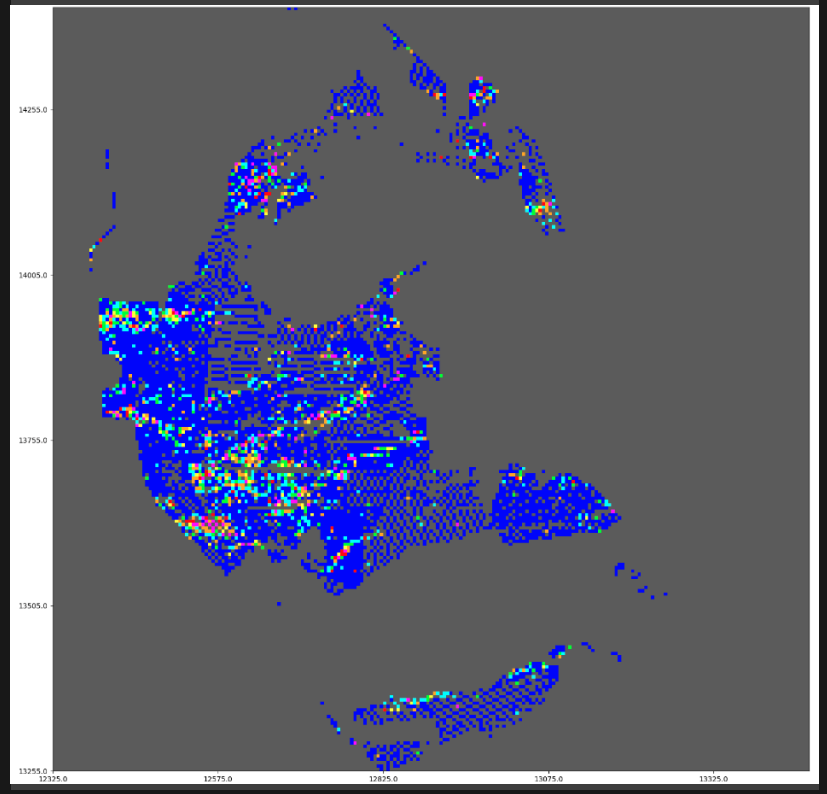


Comments: AI mineralization structure resembles ground truth closer than Kriging.

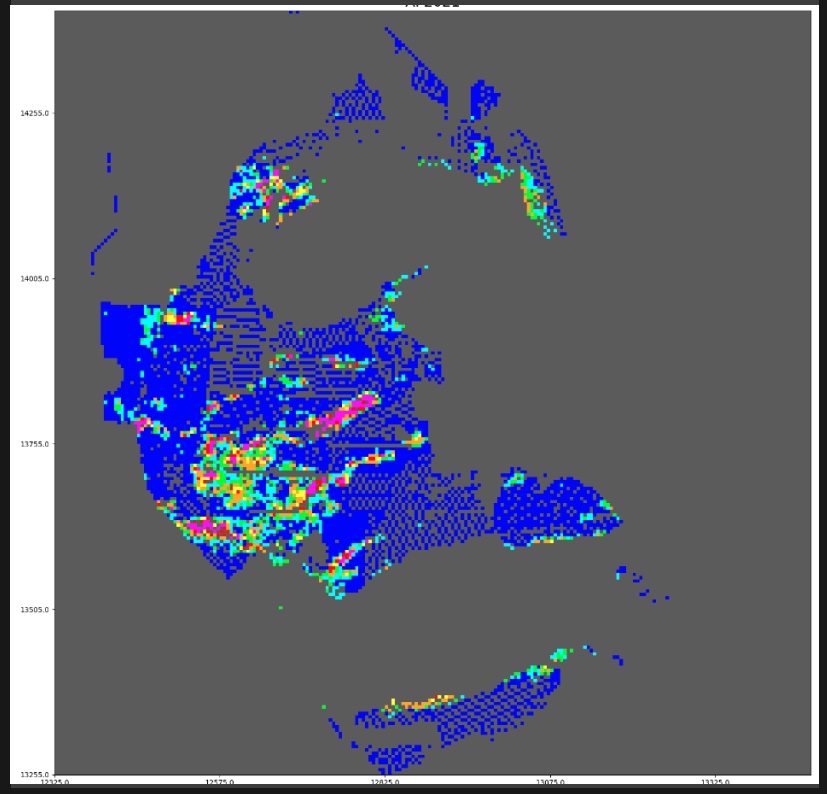
GOLD MODELLING
CROSS SECTION ANALYSIS

CROSS SECTION
Z = 260

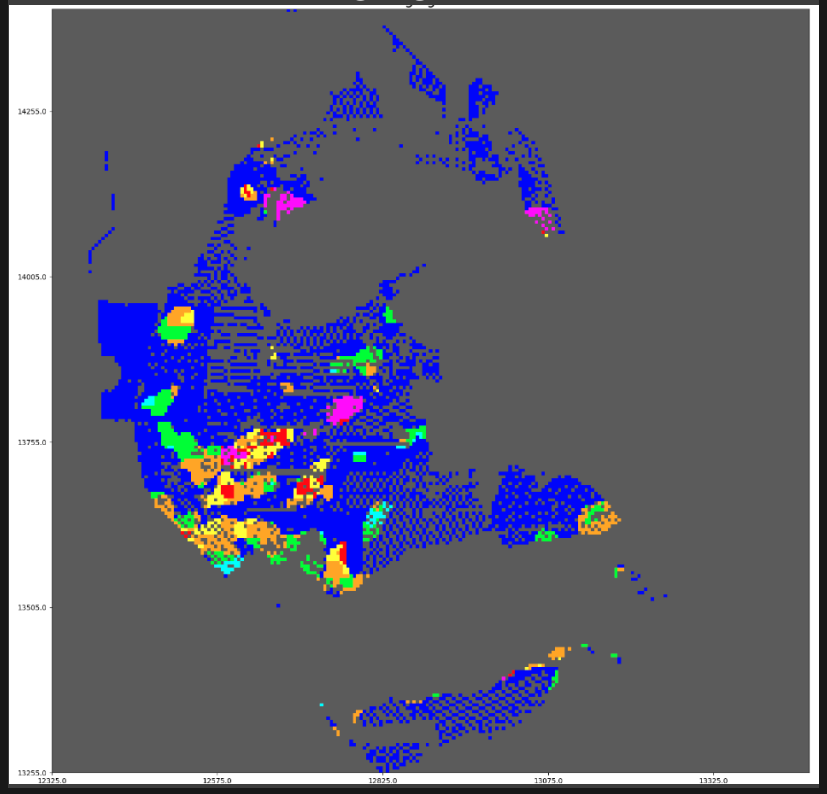
Blastholes (2021Q4-2022Q1)



AI 2021



Kriging 2021



Comments: AI mineralization structure resembles ground truth closer than Kriging.

GOLD MODELLING
SUMMARY

RESULTS

AI outperforms Kriging in F1 (blasthole) reconciliation leading to…

…improved ability to sort ore/waste

12%

HIGHER PRECISION
Translates to **12% higher probability** any predicted HG block is HG when mined

…improved ability to detect mineralization

35%

HIGHER RECALL
Translates to **~320k oz** worth of unique future drilling targets

STRATUM

LOW RISK – HIGH YIELD – AI DRIVEN