

Convolutional Neural Networks

MARS TERRAIN ANOMALY DETECTION

Data Scientist

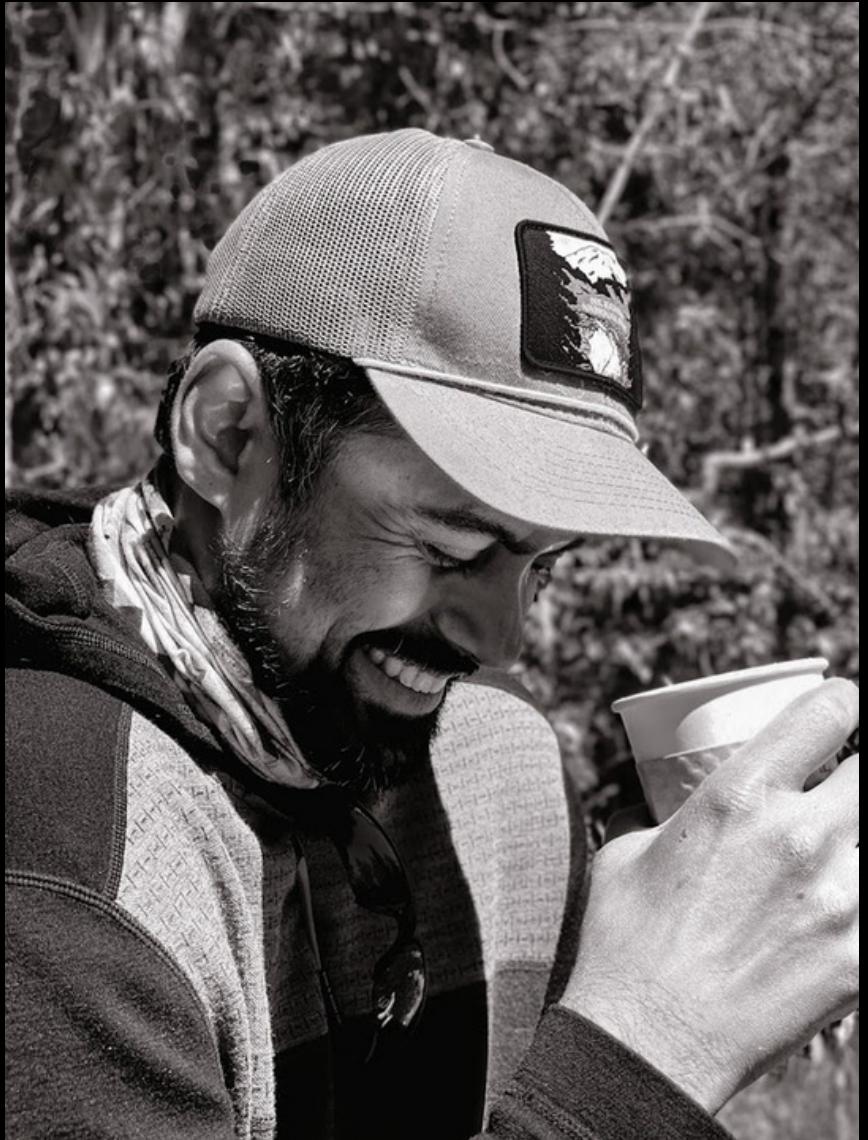


Saad Saeed

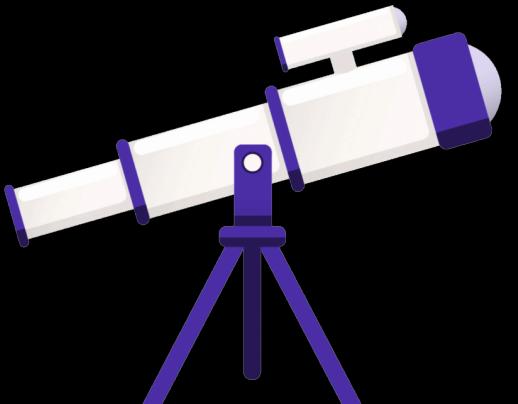


Data Scientist

Amateur photographer

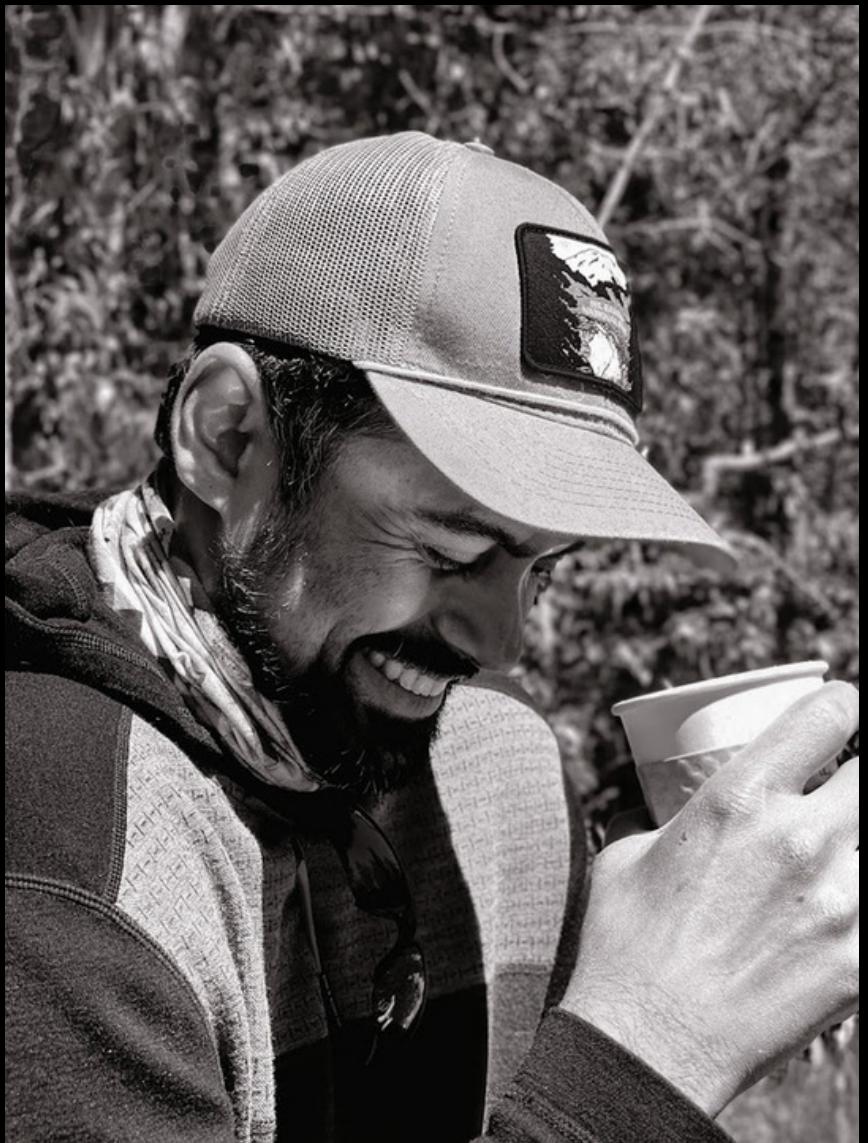


Saad Saeed

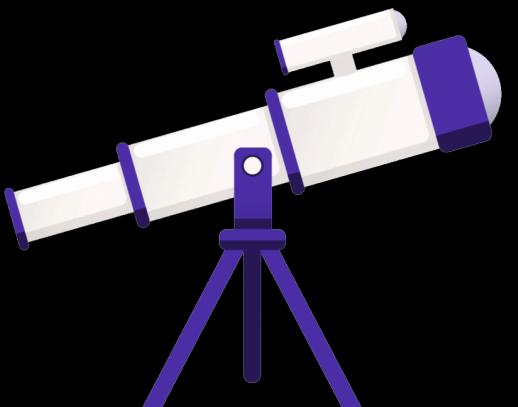


Data Scientist

Amateur photographer

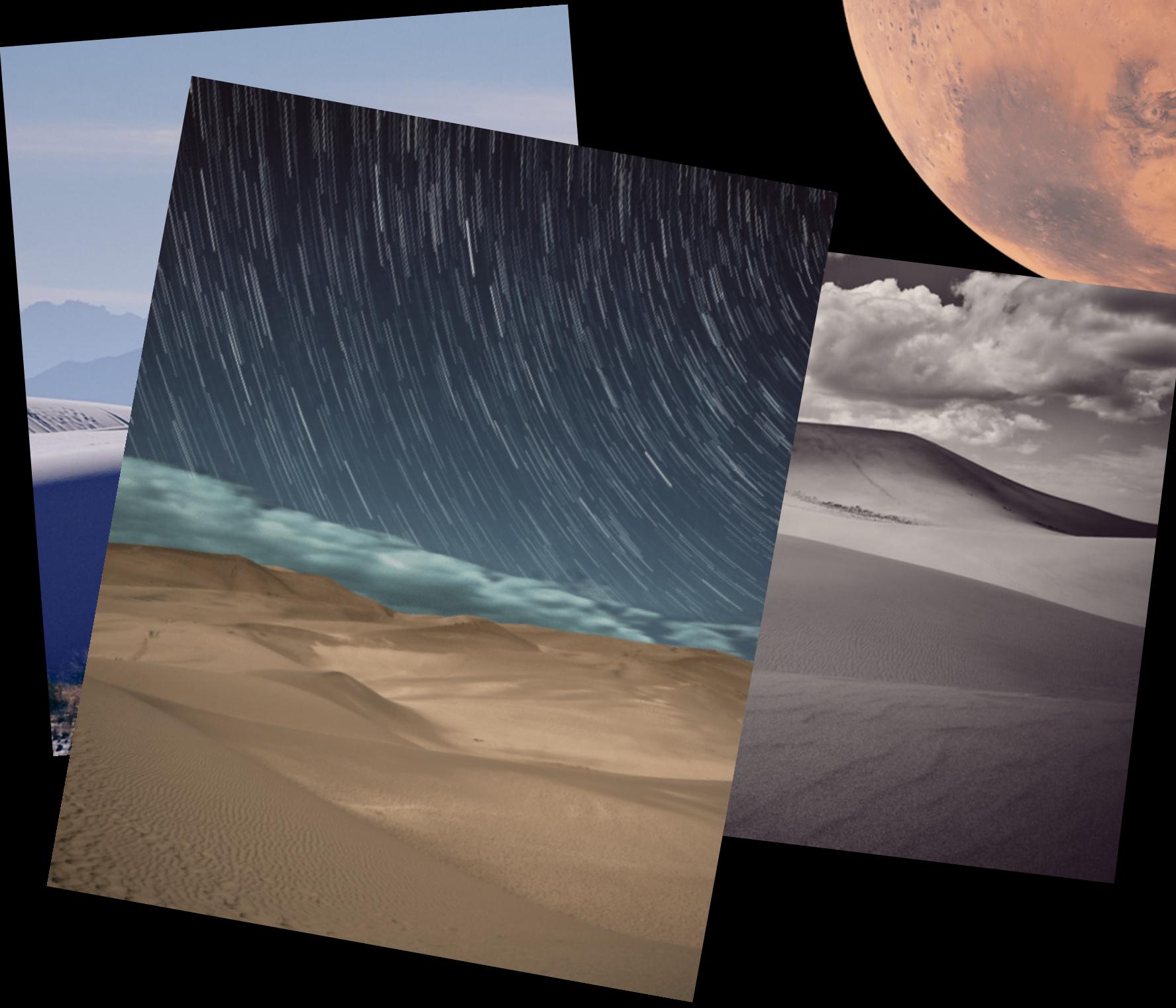


Saad Saeed



Data Scientist

Amateur photographer



Saad Saeed



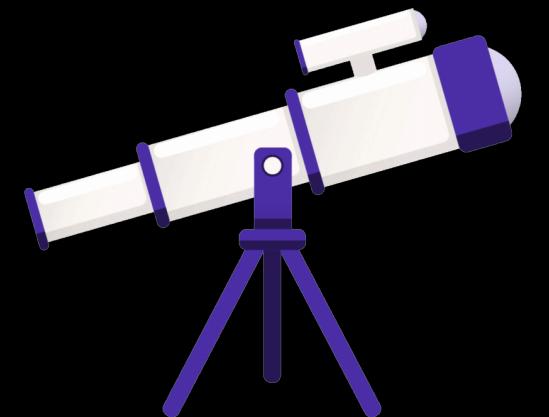
Data Scientist

Amateur photographer



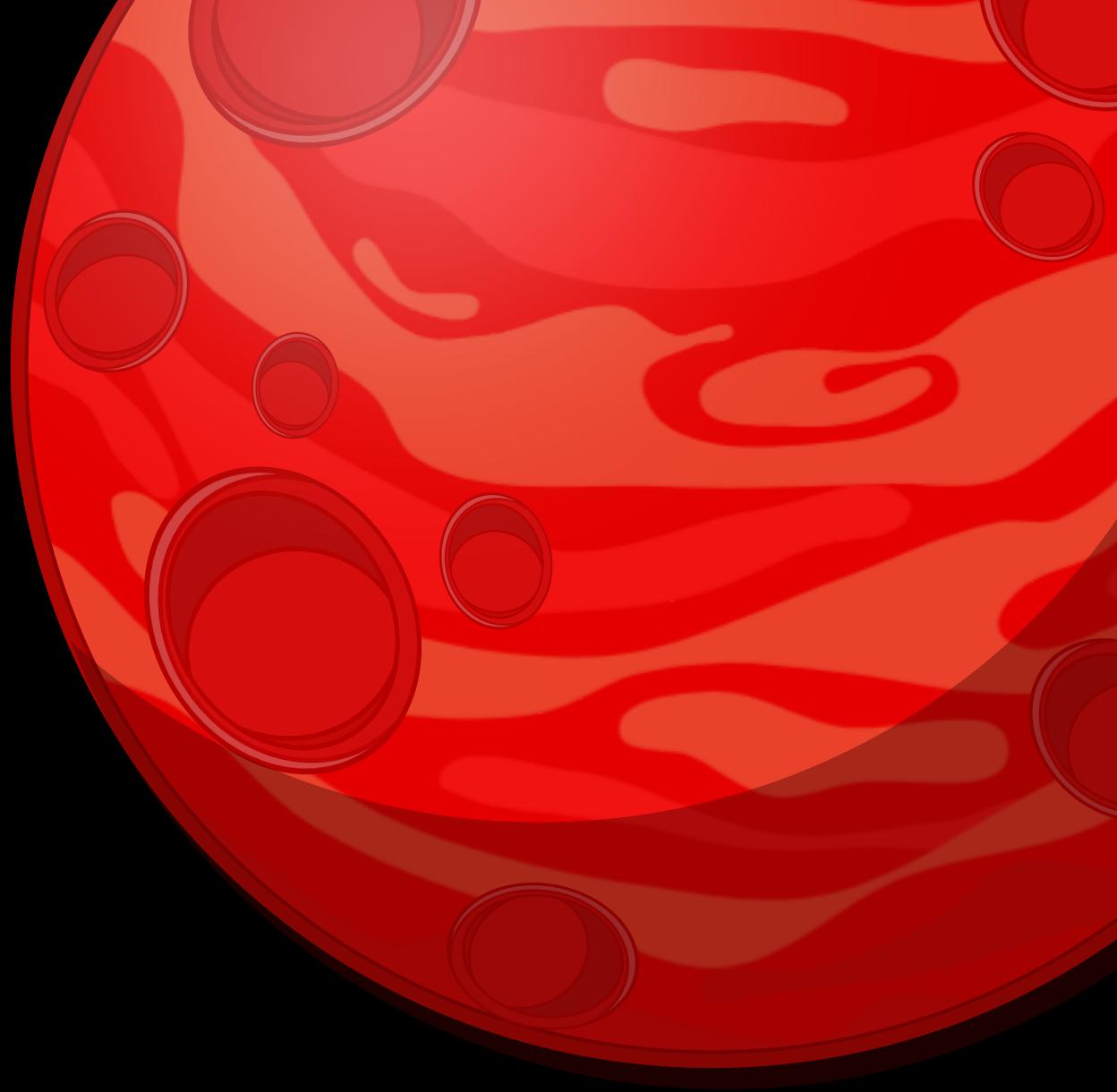
Saad Saeed

Saad Saeed

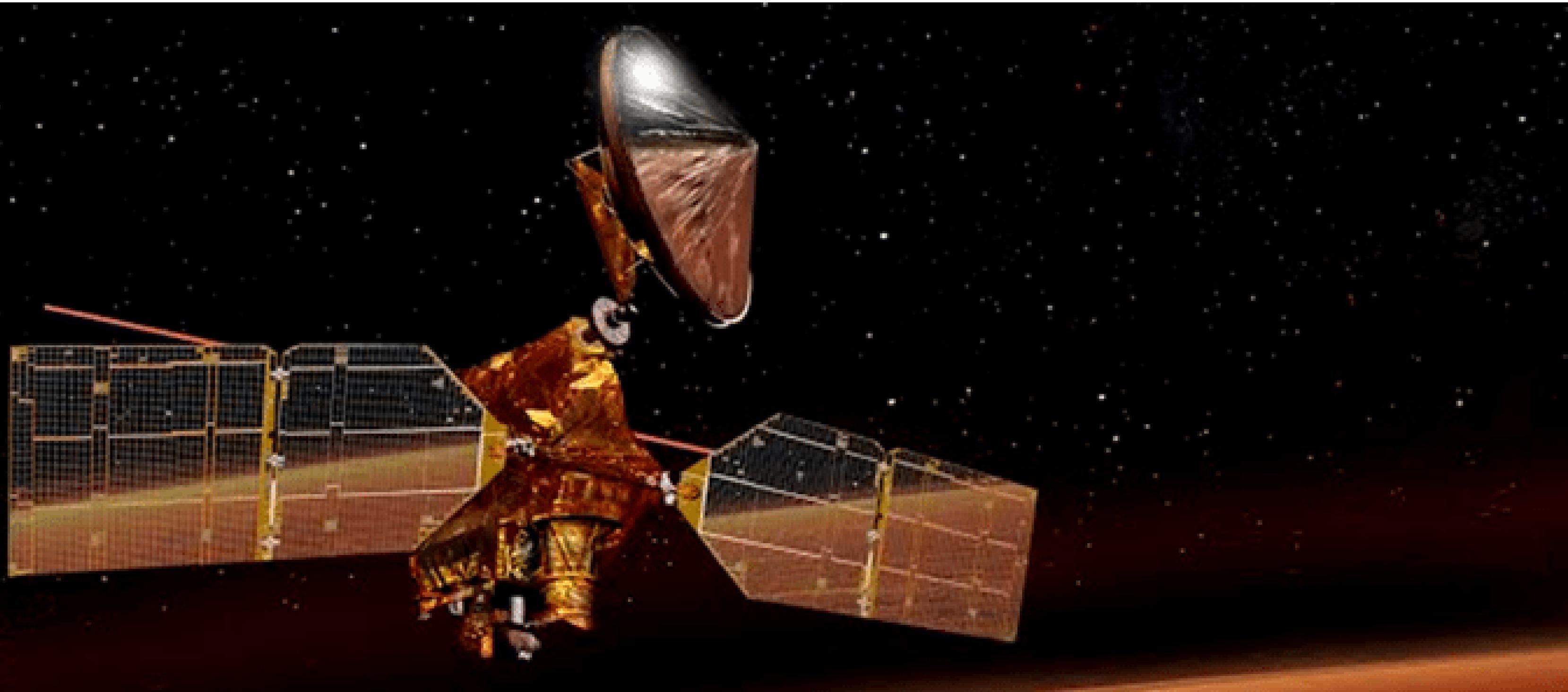


- ▶ *Intro*
- ▶ *The Data*
- ▶ *The Challenges*
- ▶ *Methodology*
- ▶ *Model Performance*
- ▶ *App*
- ▶ *Conclusion*
- ▶ *Next Steps*

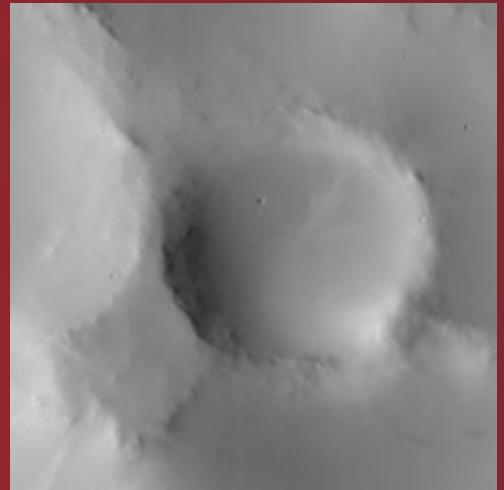
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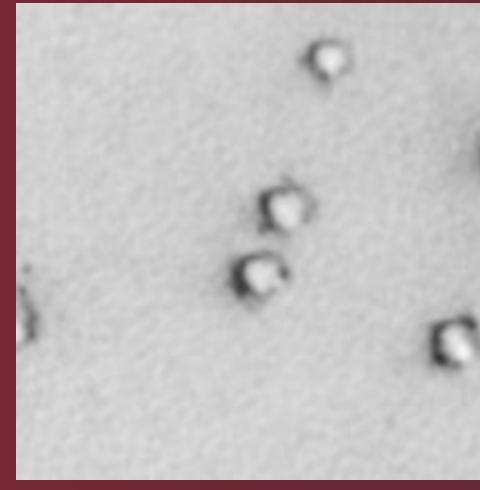
OVERVIEW



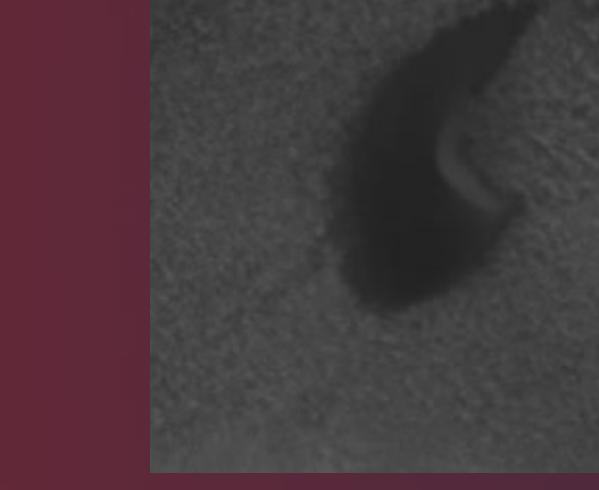
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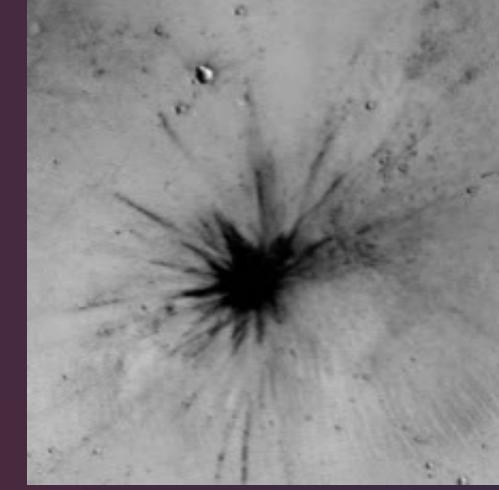
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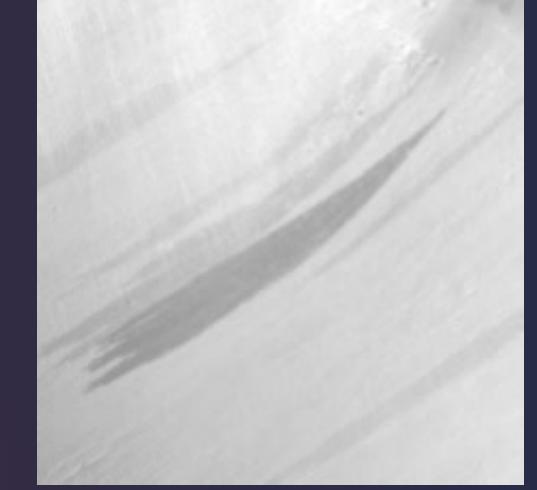
Bright
Dune



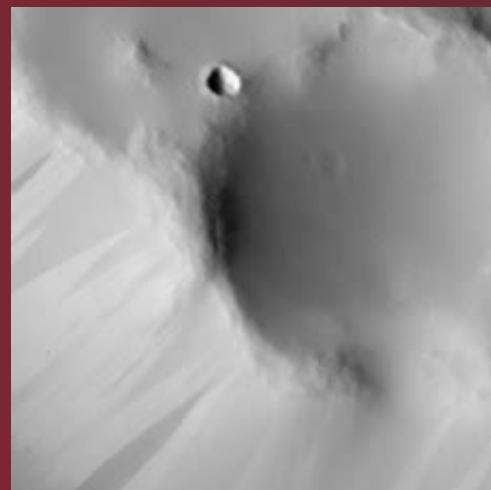
Dark Dune



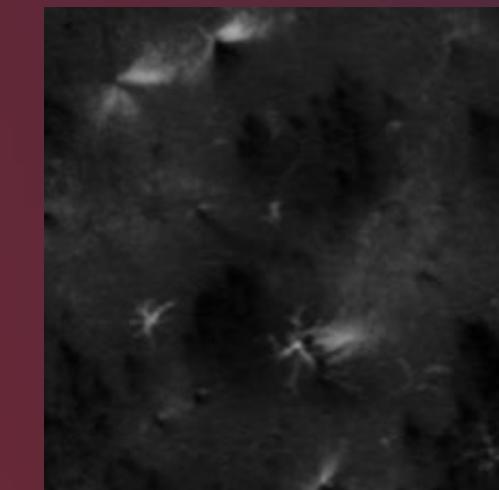
Impact
Ejecta



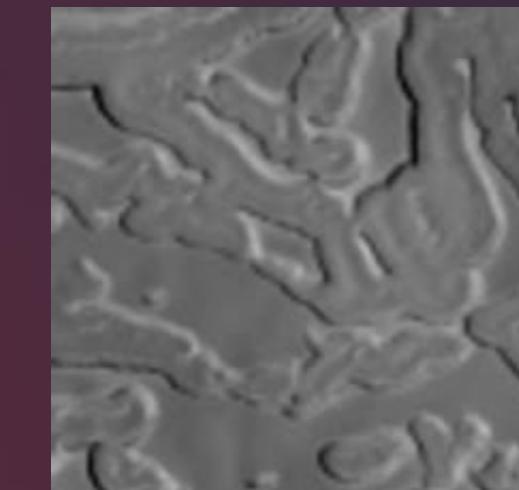
Slope
Streaks



Other

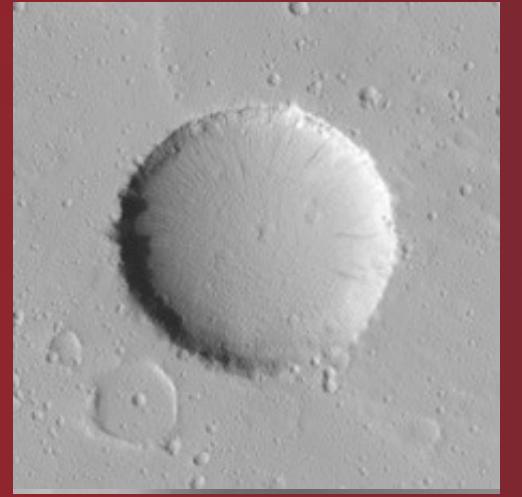


Spider



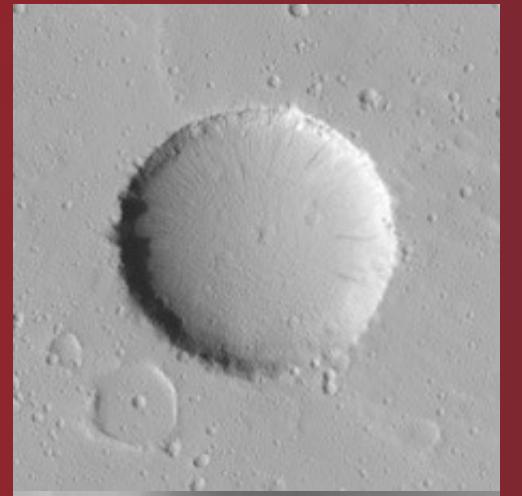
Swiss
Cheese

THE DATA

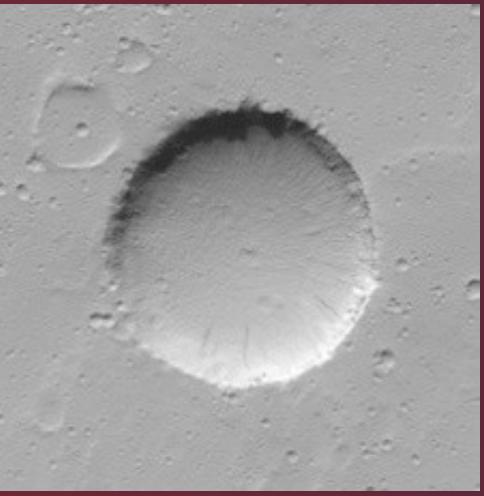


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THE DATA



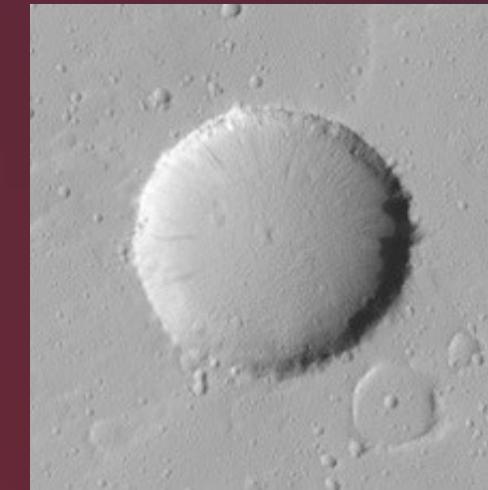
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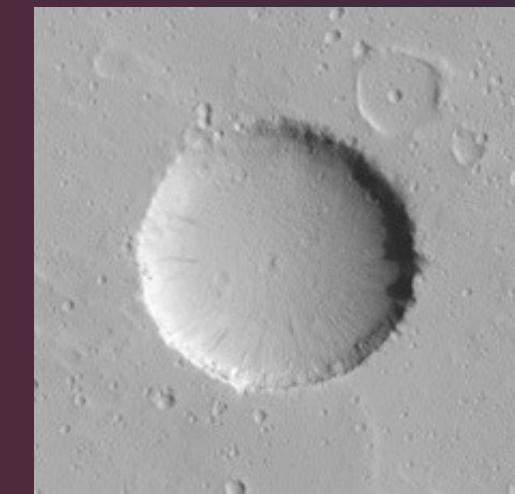
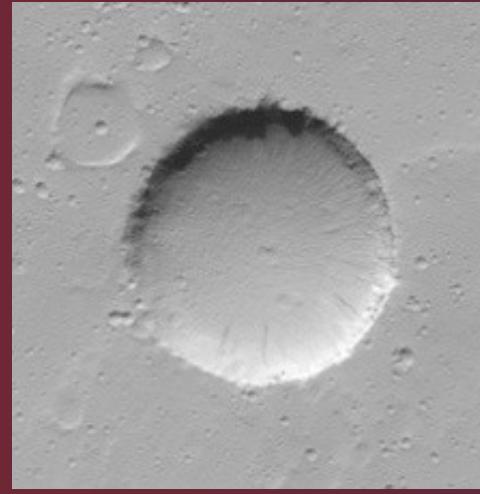
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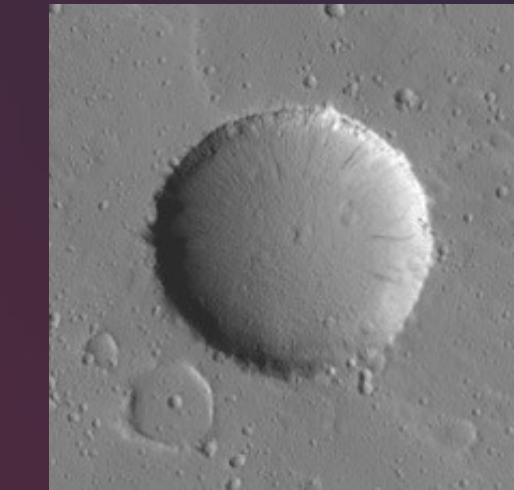
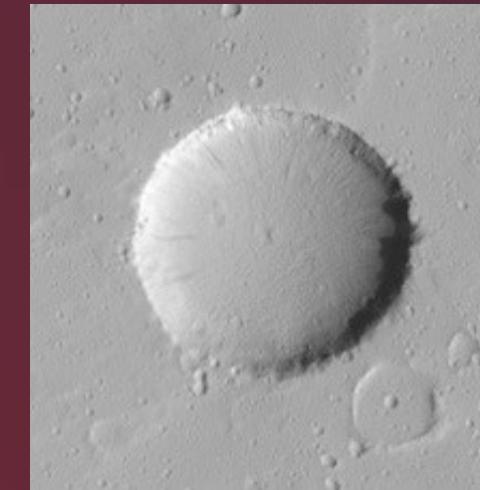
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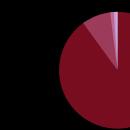
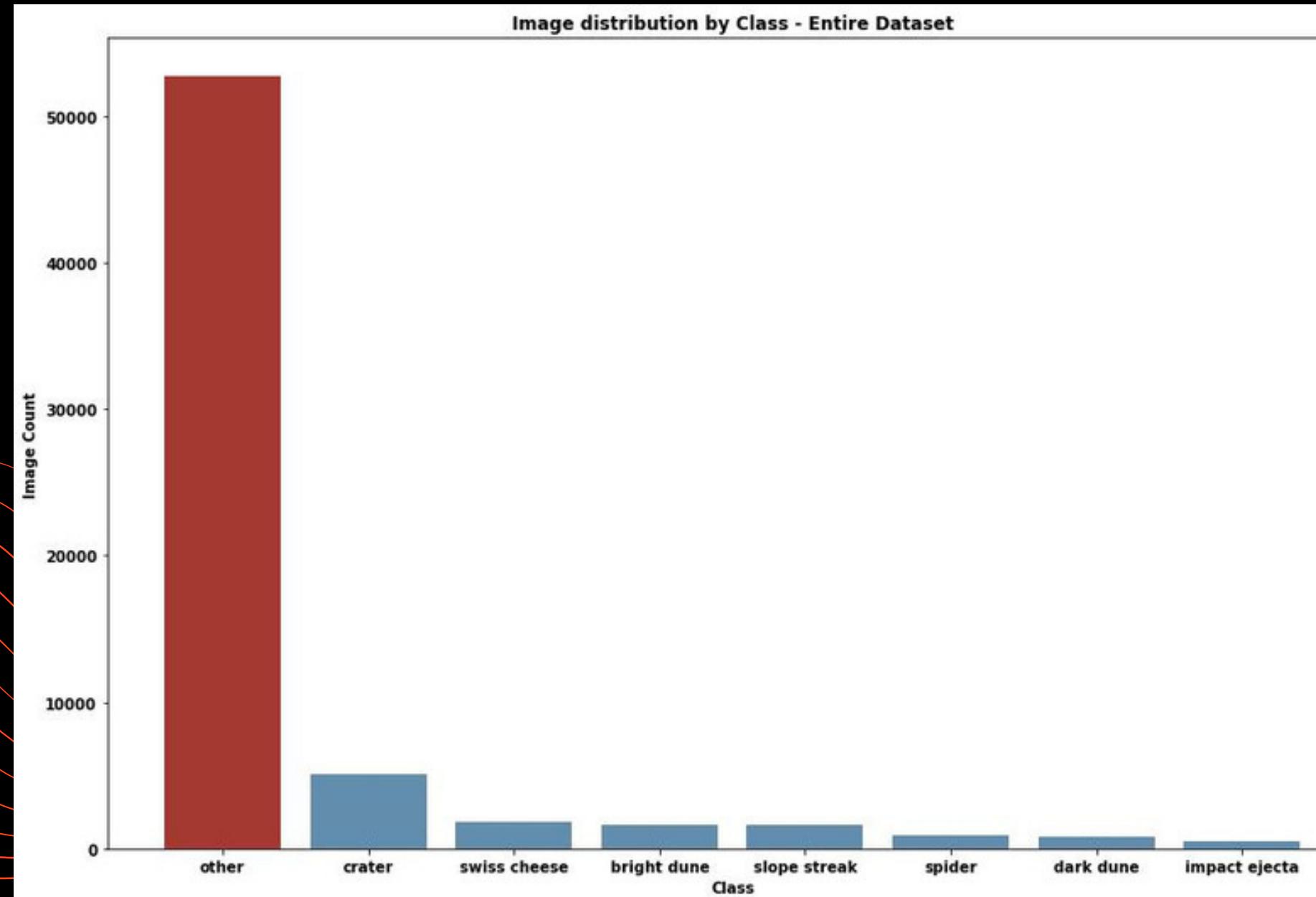


Crater



CHALLENGES

—Data and Labeling



DATA IMBALANCE

Majority Class is 80% of the data



UNDER REPRESENTATION

Less than 500 images for minority class

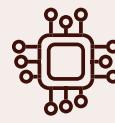


AMBIGUITY

Images in "other" are not uniform
Can be confused with another class

MODELING METHODOLOGY

—3 pronged approach

 training cnn
From scratch

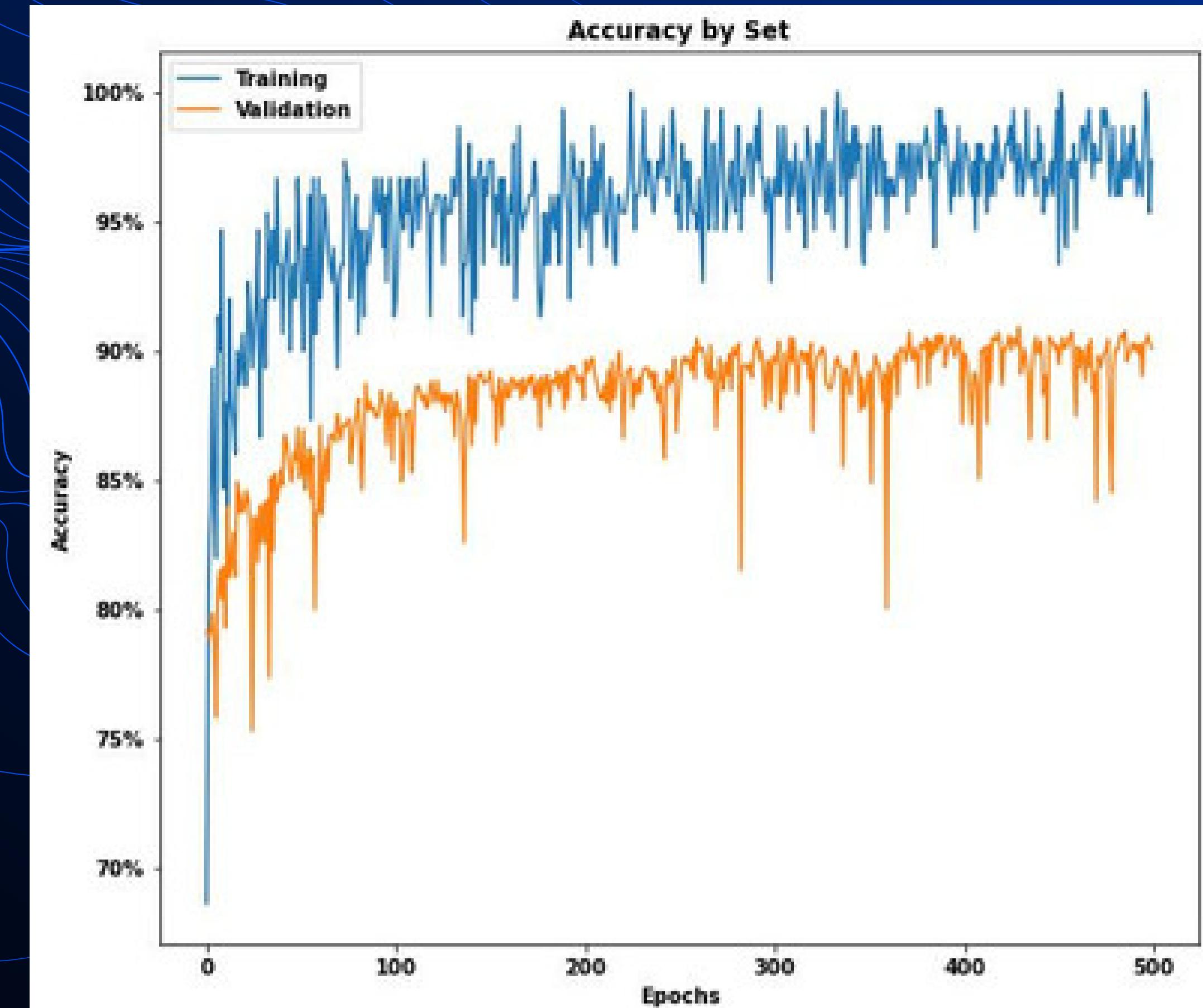
 training
established
architectures

 transfer learning



MODEL PERFORMANCE

*—accurately categorizes testing data
by 92%*



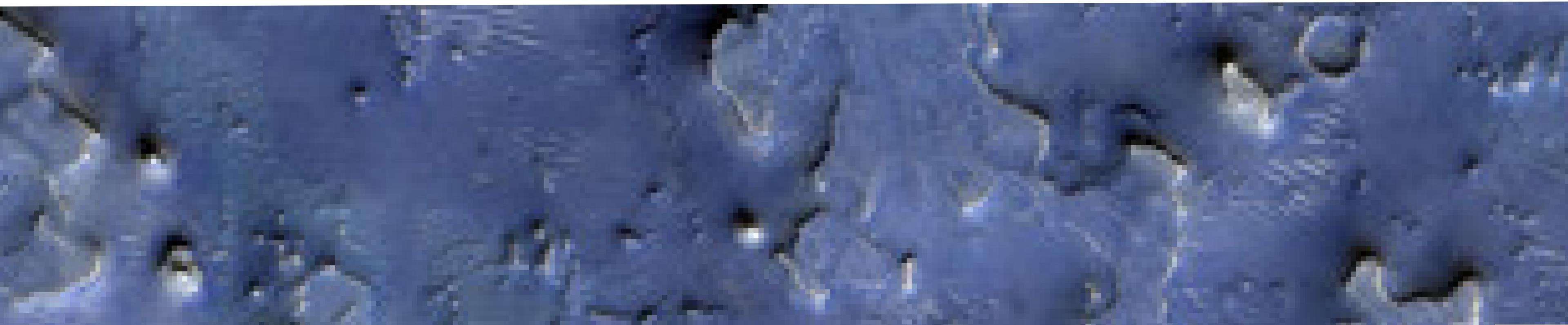
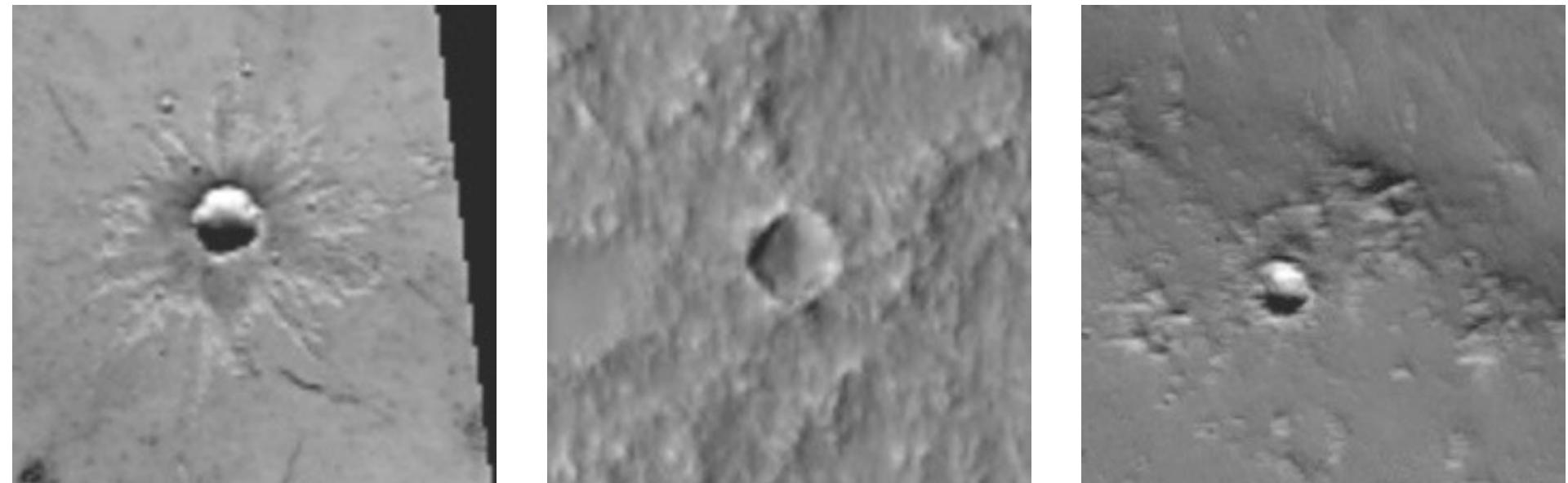
APP

<https://www.uahirise.org/>



CONCLUSION

- transfer learning is exceedingly powerful
- confounding images are problematic



NEXT STEPS

MORE DATA

- Collect more data
- Label more data



REASSESS CLASS

- Reclassify
- Reconsider how we are currently classifying our images

RETRAIN

- Use a different metric
- Try other architectures

UNDERSAMPLE

- Random subset of majority class
- Drop majority class

IOU

- Intersection over Union to clean up annotations

**THANK YOU
FOR YOUR
TIME**



saadsaeed85@gmail.com