



4. Conclusion





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Table. Information of TianQin Station

Parameters	Value	
	value	
Wavelength	1064nm	
Pulse Energy	300mJ	
Pulse Width	< 80ps	
Nominal Fire Rate	100Hz	
Tracking Accuracy	<1"	
Telescope Aperture	1.2m	
System Detection Efficiency	30%	
Dark Count	2kHz	
Time Resolution	1ps	







- The distance 380,000km
- The strong noise
- The small reflector

What is detection?

Before extracting, make sure there are signals.



Figure.1 Lunar



Figure.2 LLR Data









YOLO supports multiple computer vision tasks, like detection, classification

Ultralytics is a company focused on computer vision and deep learning, offering a range of open-source projects



YOLO Vision 2024 is here!

September 27, 2024 (b) Free hybrid event

中山大学·天琴中心 http://tianqin.sysu.edu.cn/

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In LLR, the effective signals are on the low side.

In order to achieve different signal-to-noise ratios (SNR), we construct laser ranging residuals with varying SNR from existing laser ranging data using the method of random sampling.





Model and Data



Change the SNSPD $6.3\mu A \rightarrow 5.7\mu A$



In addition to simulating low SNR data, it is possible to create lower SNR conditions

The number of signals: [4372, 2908, 4227, 4638]→[2217, 1974, 2012, 2248]

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Change the f



[12082, 2326, 12117, 12244]→[785, 183, 947, 681]



Red: Channel 4

Blue: Channel 1

Yello: Channel 2

Green: Channel 3







Our model will provide a probability for each input data point, and signals are identified as those with probabilities higher than the threshold.





Figure.3 Confusion matrix for val data

Figure.4 SNR vs. average probability



The SNR of measured data varies from -14.8226 dB to -5.24083 dB. The red points are \rightarrow



a

b

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Figure. SNR of measured data with probability





- Computer vision can be well applied in laser ranging signal detection, which can assist human to make some judgment.
- The SNR is not a complete characterization of the ranging residuals, and it may be necessary to design some new quantities to describe them.
- LLR data are affected by a variety of factors. To improve the applicability of the model, the data set can be expanded to include more diverse ranging data cases.

