

# Wound Etiology Detection Using Machine Learning: An Introduction to YOLOV8 in Wound Care

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## Introduction

- Venous ulcers (VU) are typically shallow, irregularly shaped, and have defined borders [1].
- Diabetic foot ulcers (DFUs) are a result of damage done to both the large and small arterial vessels in the lower extremity [2].
  - Small vessel damage hinders adequate perfusion to the nerves of the foot, which leads to peripheral neuropathy.
  - Diabetic patients who have peripheral neuropathy are not aware of the minor traumas that occur to their feet → These repeated traumas lead to ulceration [2].
- You Only Look Once version 8 (YOLOv8) is the 8th iteration of a real-time object detection and image segmentation model created by Ultralytics [3].

## Objective

- The objective of this pilot study is to assess the efficacy of YOLOv8 in differentiating a VU from DFU.

## Methods

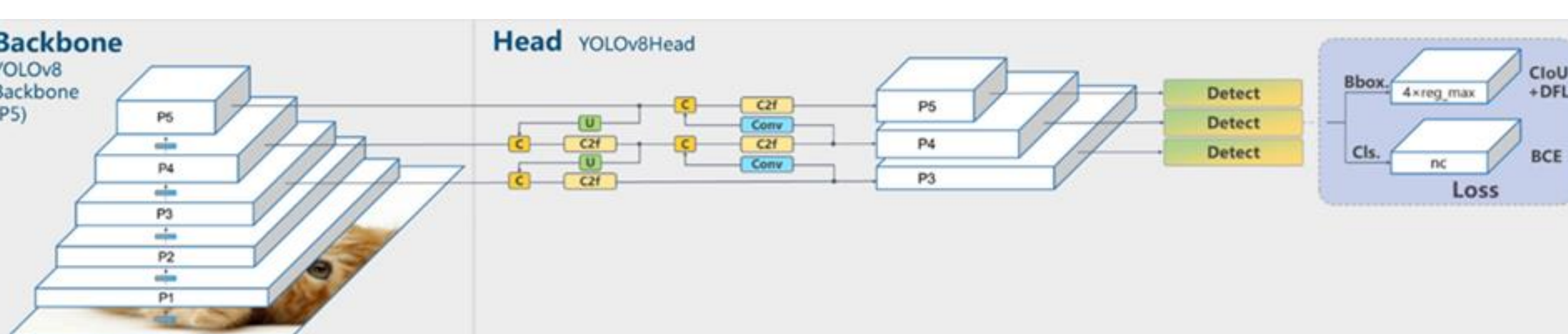
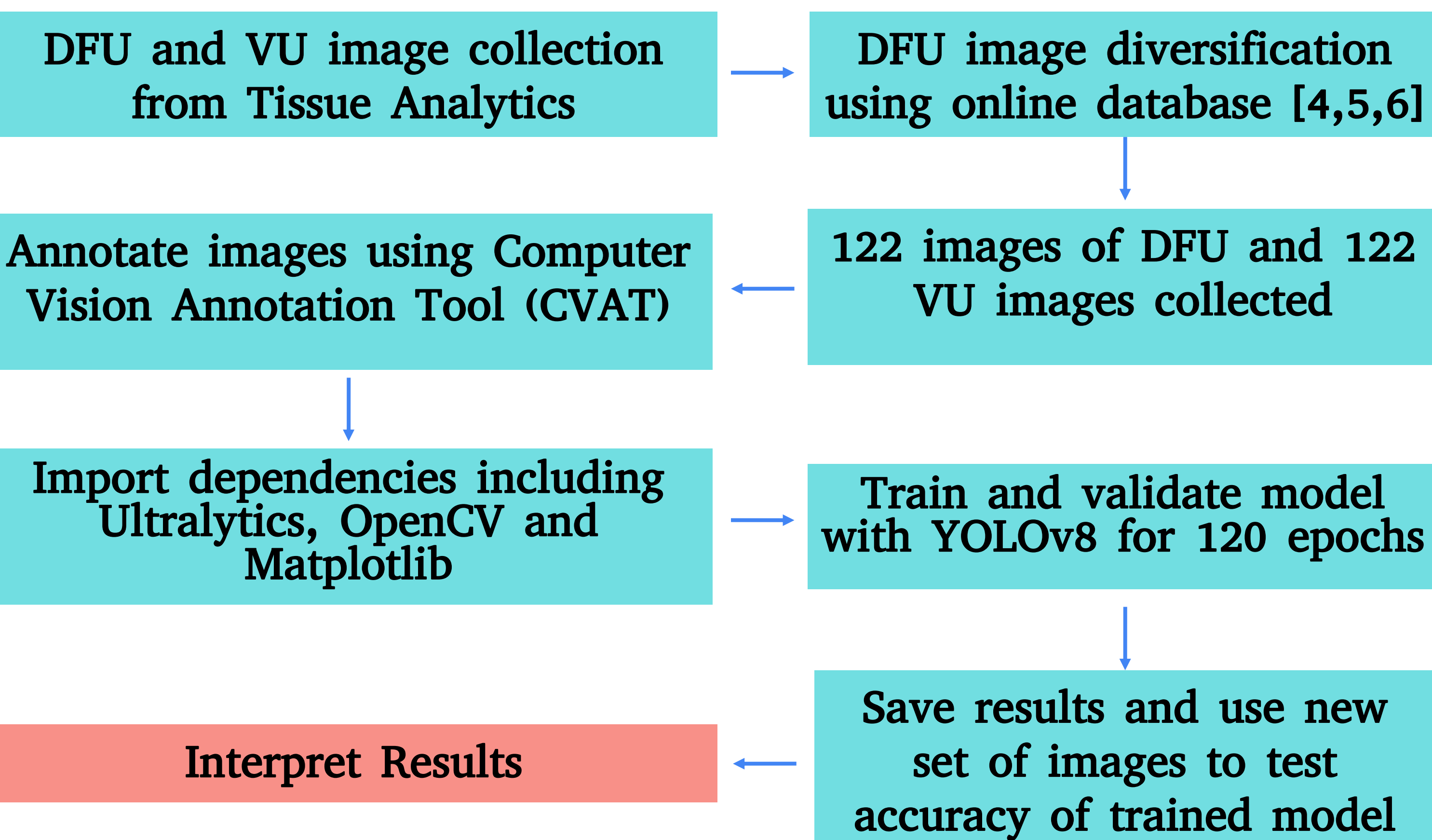


Figure 1: YOLOv8 Architecture. Visualization made by Github user RangeKing [7]

## Results

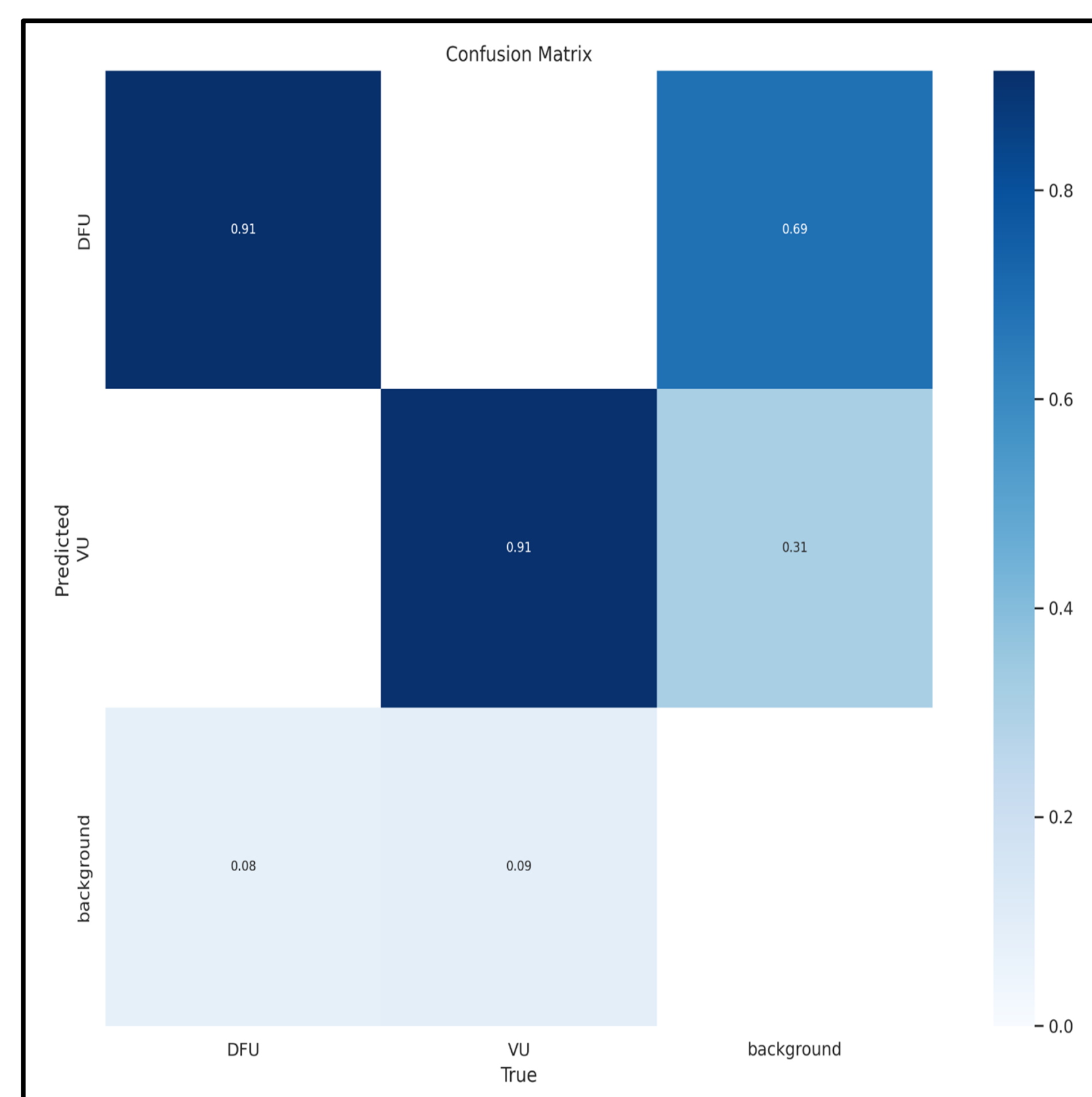


Figure 2: Confusion matrix

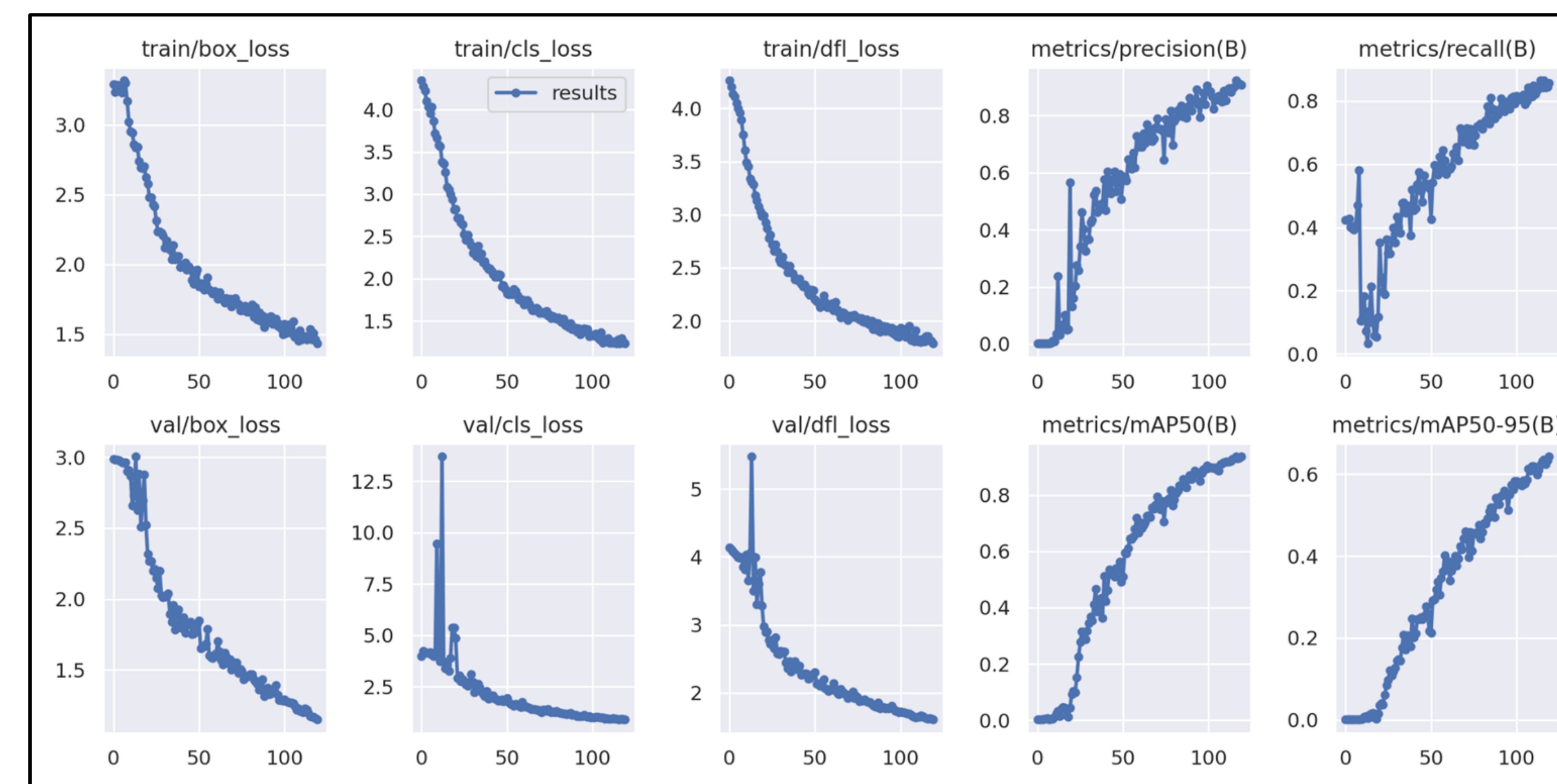


Figure 3: Results of training session

	Confidence	
	DFU	VU
Median	0.720	0.540
Mean	0.699	0.524
Std. Deviation	0.118	0.133
Minimum	0.410	0.270
Maximum	0.830	0.660

Table 1: Accuracy measurements between DFU and VU for 10 test images

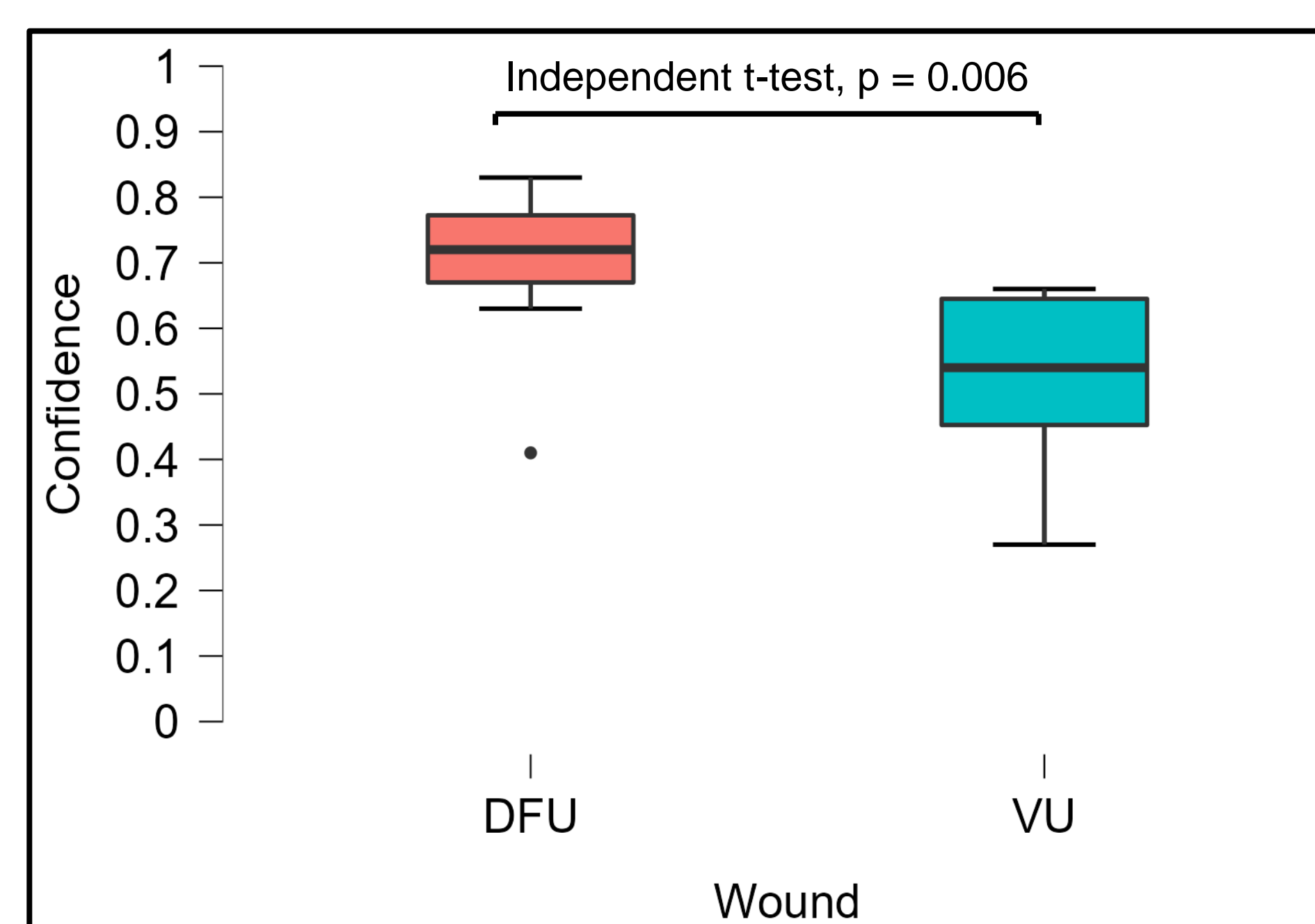


Figure 4: Accuracy difference between DFU and VU for 10 test images

## Future Studies

- The study can be repeated with different, more complex wounds.
- Increased image dataset in order to increase accuracy of model.
- Compare the YOLOv8 model with other machine learning algorithms.
- Deploy model on android app and test in real-time on real patients.

## Limitations

- A small dataset of only 244 images was used for training the model.
- A small dataset of only 10 images were used to test the model.
- Images and classifications were not as complex.

## Conclusions

- YOLOv8 is an extremely versatile image detection, identification and segmentation tool, and this study shows its efficacy in detecting between DFU and VU wounds with commendable accuracy (~90%).
  - Using more images to train the model will increase accuracy.
- The mean confidence of detecting DFU (0.70) and VU (0.524) is also remarkable.

## References (cited in APA)

1. Bonkemeyer Millan, S., Gan, R., & Townsend, P. E. (2019). Venous Ulcers: Diagnosis and Treatment. *American family physician*, 100(5), 298–305.
2. Grennan D. Diabetic Foot Ulcers. *JAMA*. 2019;321(1):114. doi:10.1001/jama.2018.18323.
3. Solawetz, J., JAN 11, F., & Read, 2023 10 Min. (2023, January 11). *What is YOLOv8? The Ultimate Guide*. Roboflow Blog. <https://blog.roboflow.com/whats-new-in-yolov8/>
4. Alzubaidi, L., Fadhel, M. A., Olewi, S. R., Al-Shamma, O., & Zhang, J. (2020). DFU\_QUTNet: diabetic foot ulcer classification using novel deep convolutional neural network. *Multimedia Tools and Applications*, 79(21), 15655–15677.
5. Alzubaidi, Laith, Mohammed A. Fadhel, Omran Al-Shamma, Jinglan Zhang, J. Santamaria, and Ye Duan. "Robust application of new deep learning tools: an experimental study in medical imaging." *Multimedia Tools and Applications* (2021): 1-29.
6. Alzubaidi, Laith, Mohammed A. Fadhel, Omran Al-Shamma, Jinglan Zhang, J. Santamaria, Ye Duan, and Sameer R Olewi. "Towards a better understanding of transfer learning for medical imaging: a case study." *Applied Sciences* 10, no. 13 (2020): 4523.
7. *Brief summary of YOLOv8 model structure - Issue #189 · ultralytics/ultralytics*. (2023, January 10). GitHub. <https://github.com/ultralytics/ultralytics/issues/189>.