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Annotation of Calibration Patterns for RGB-LiDAR Evaluations using Segmentation Models

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Definição do problema

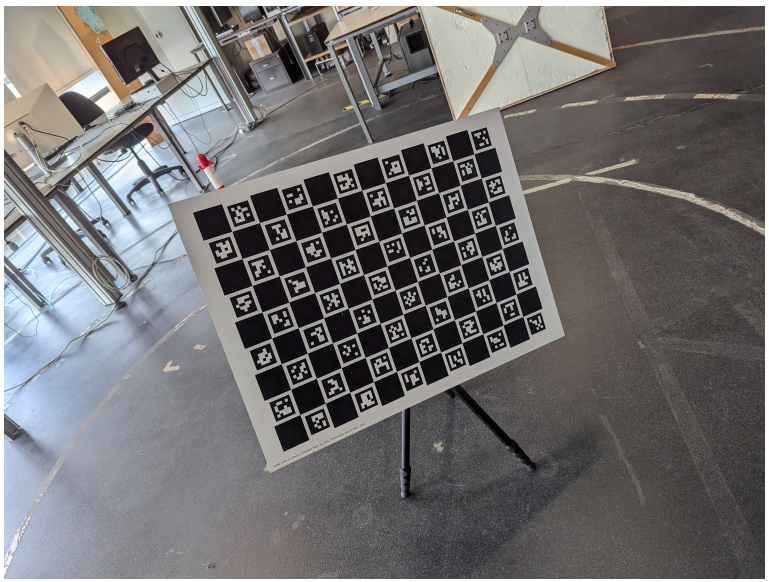
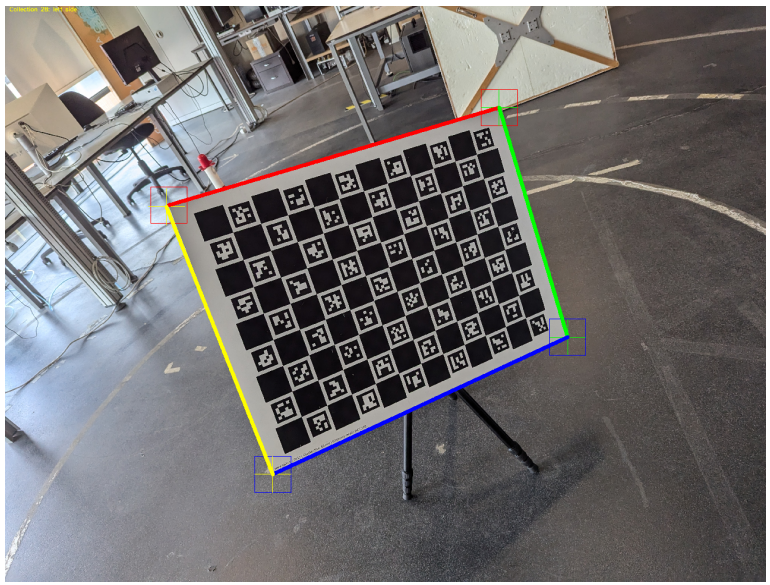


Imagem de entrada



Resultado esperado

Escolha do tipo de rede
Modelos de Segmentação

- Número de cantos variável visíveis na imagem;
- Possíveis obstruções parciais do padrão;
- Solução CNN + FC inviável por tamanho do output variavél;
- Rede de segmentação evita todos os possíveis os edge cases.

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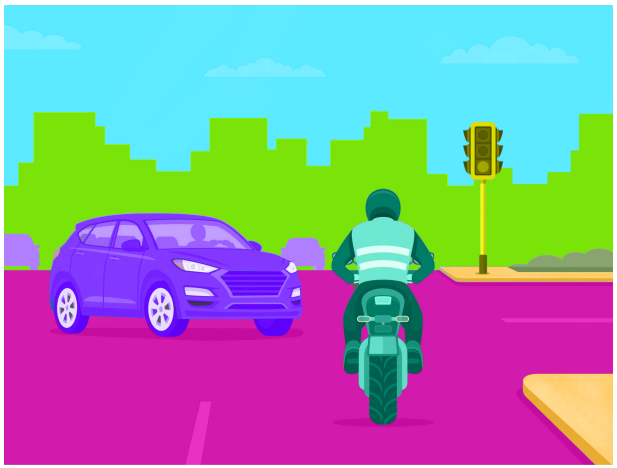
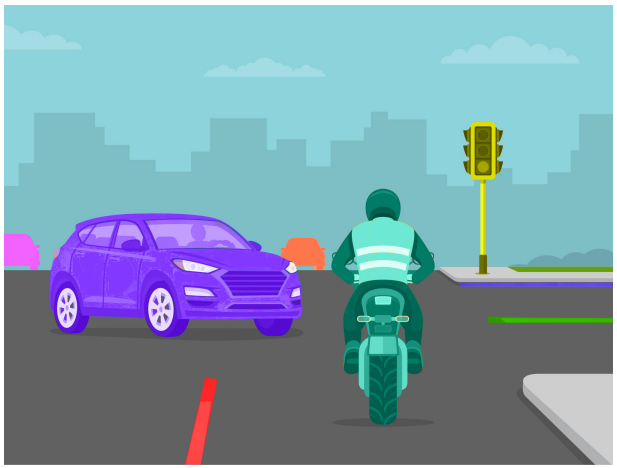
Tipos de redes de segmentação



Semântica



De instâncias

Panóptica

Aquisição do dataset

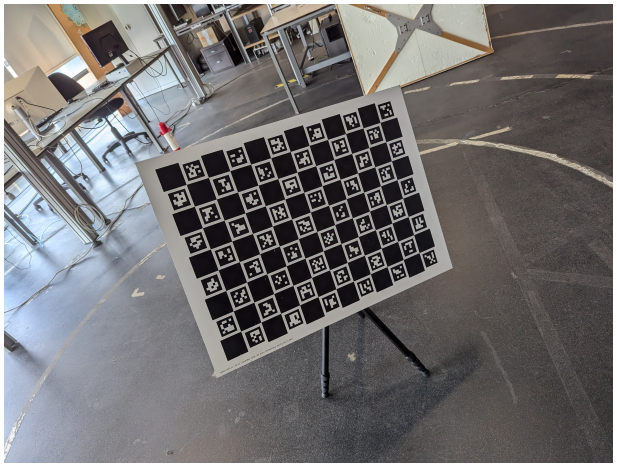
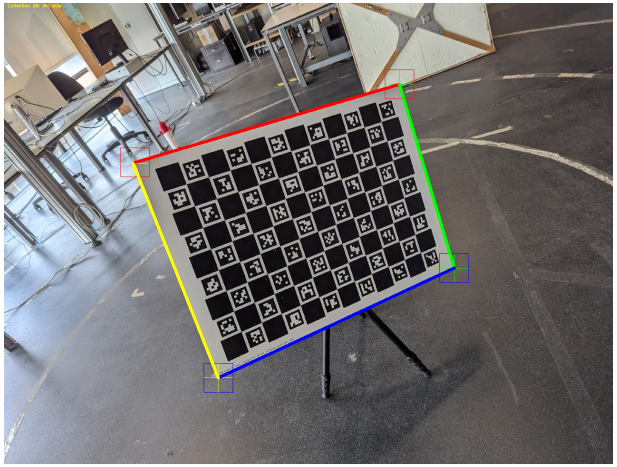
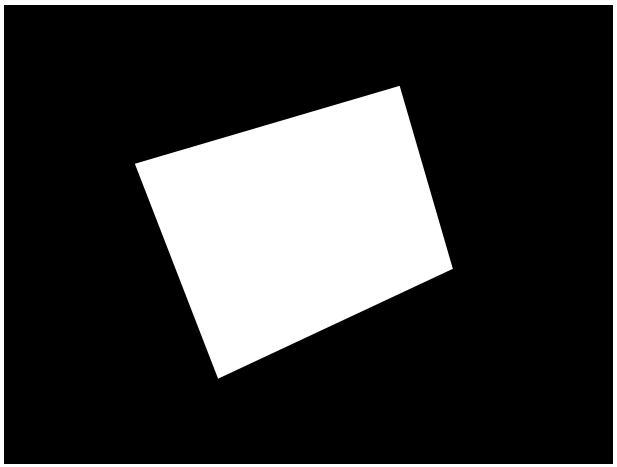


Imagem original



Anotações no ATOM



Conversão das linhas de contorno para uma máscara

Seleção de modelos

- Modelos pre-treinados do PyTorch
  - DeepLabV3
  - Fully Convolutional Network for Semantic Segmentation
  - LRASPP
- U-Net

Setup de treino

- *Loss function*: *Binary cross-entropy loss*
- *Optimizer*: Adam
- *Batch size*: Máximo possível para a GPU
- Imagens com uma resolução de 512x512 pixeis
- 200 Épocas por treino

DeepLabV3
Com backbone Resnet50

- 41M de parâmetros
- 17M treinaveis

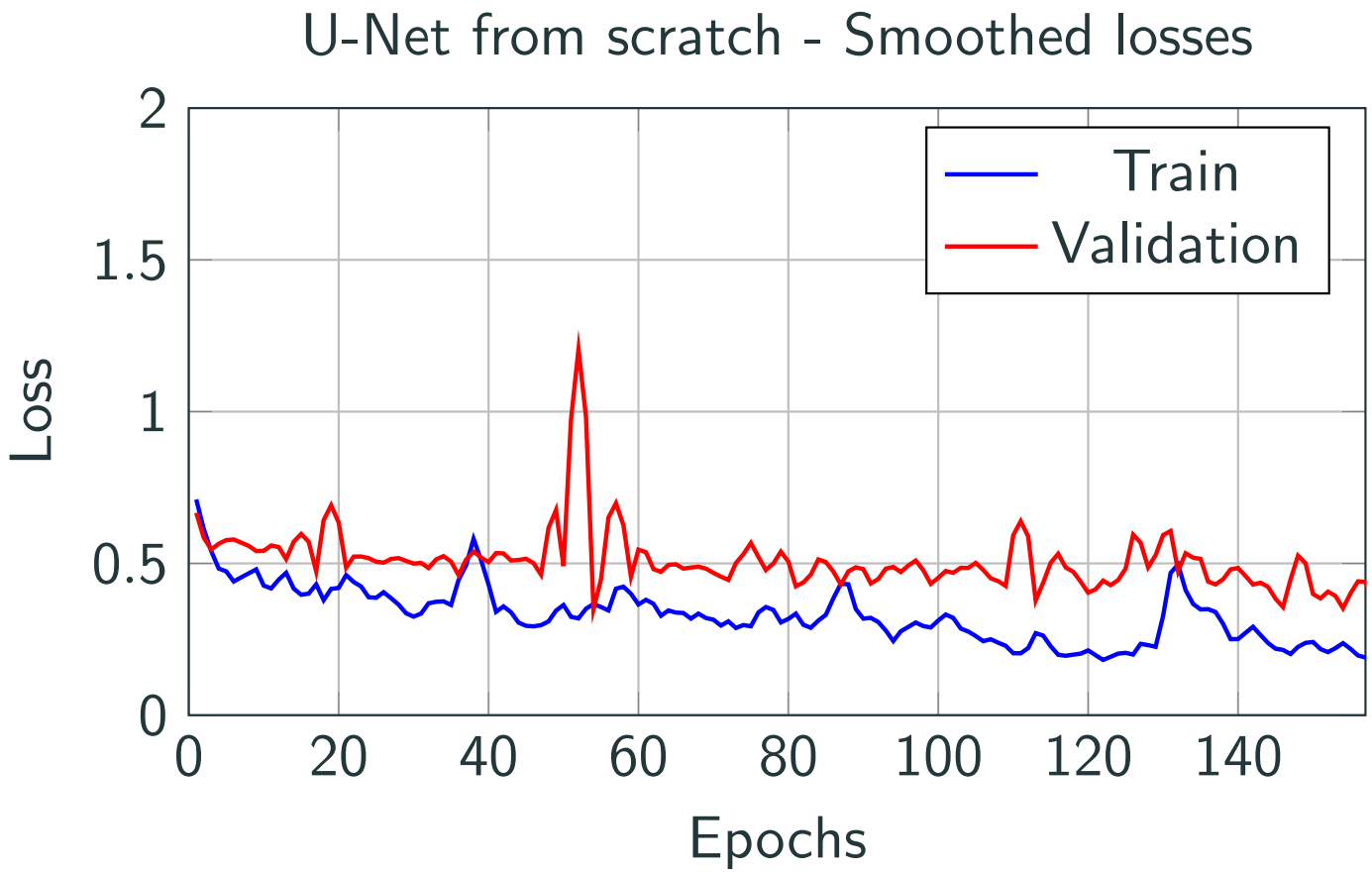
- Não houve convergência
- Complicações com o treino

U-net
Treinada do raíz

- 33M de parâmetros
- 33M treinaveis

- Exatidão de 76%
  Época 157

U-net
Treinada do raíz



U-net
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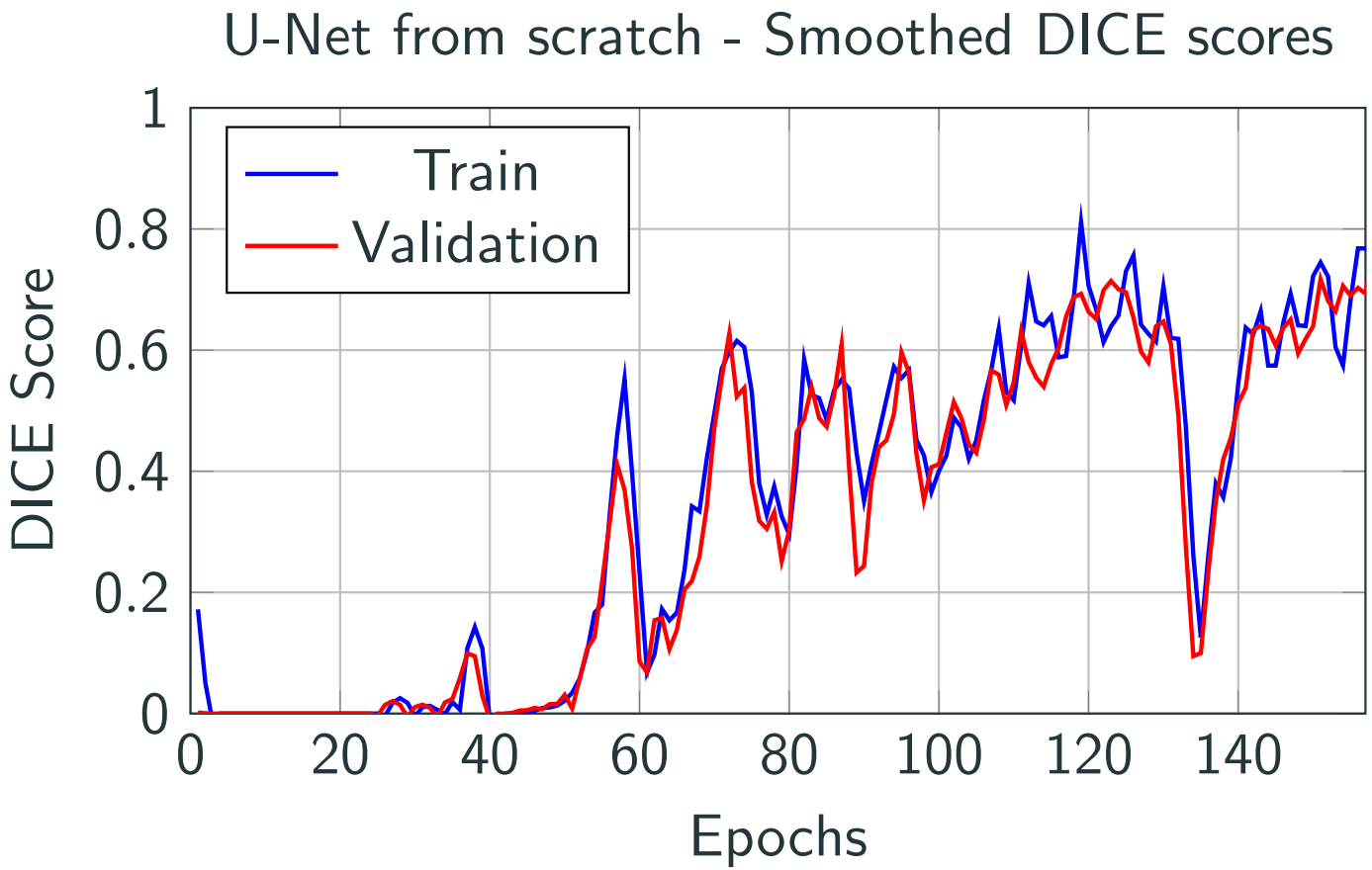
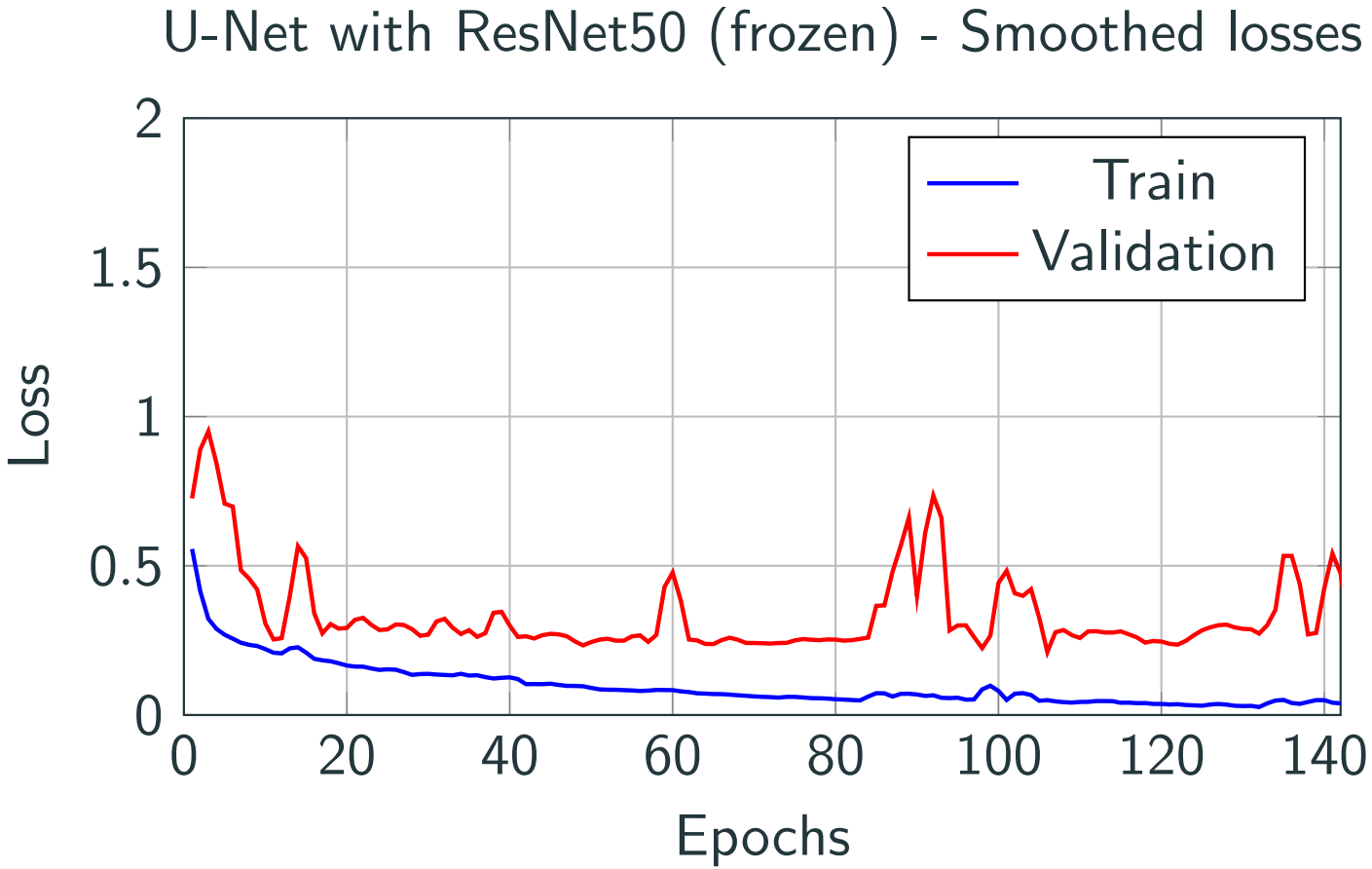


U-net
Com Resnet50 Backbone

- 148M de parâmetros
- 124M treinaveis

- Exatidão de 85%
  Época 142

U-net
Com Resnet50 Backbone



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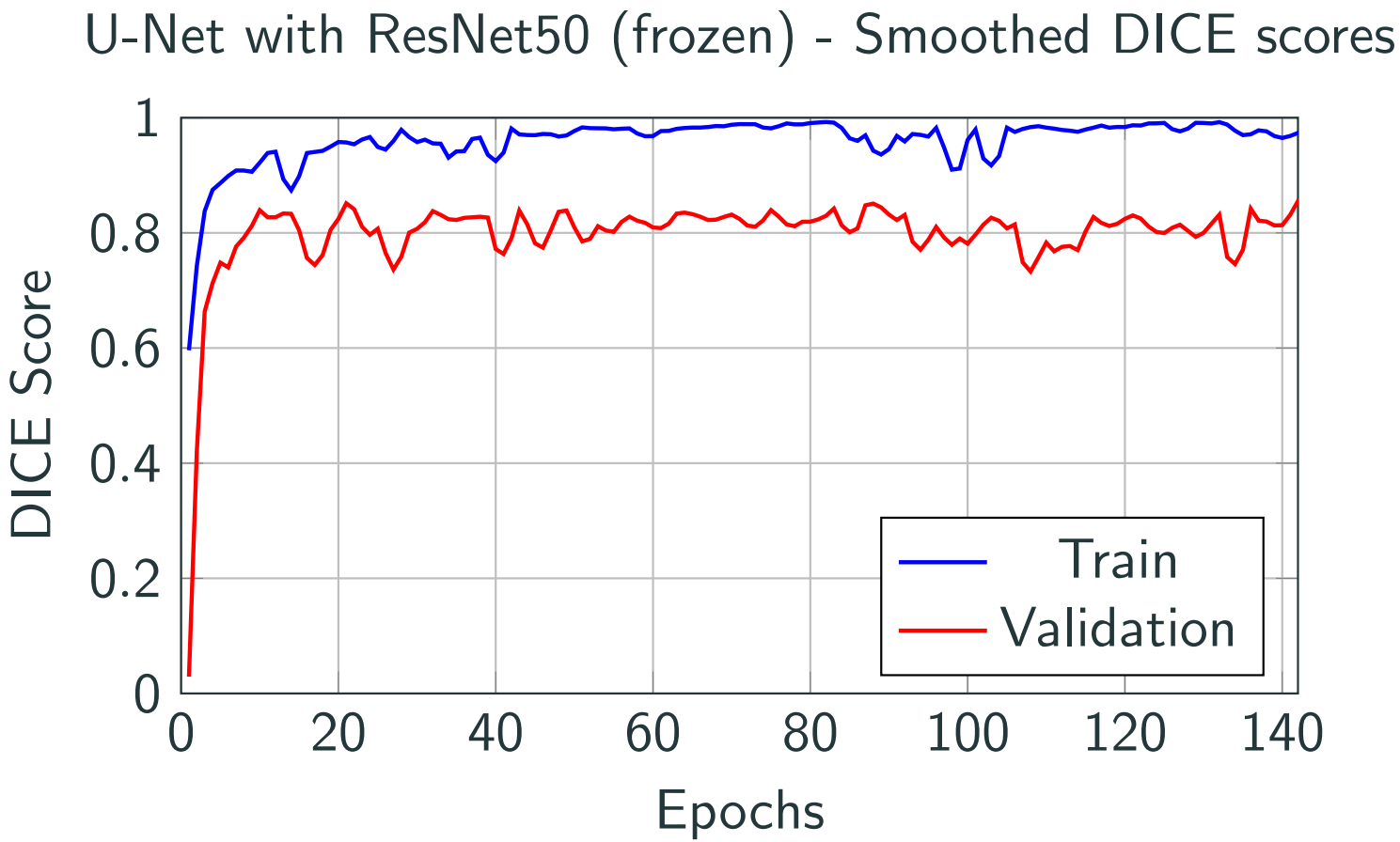

U-net
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- 148M de parâmetros
- 148M treinaveis

- Exatidão de 85%
  Época 17

U-net
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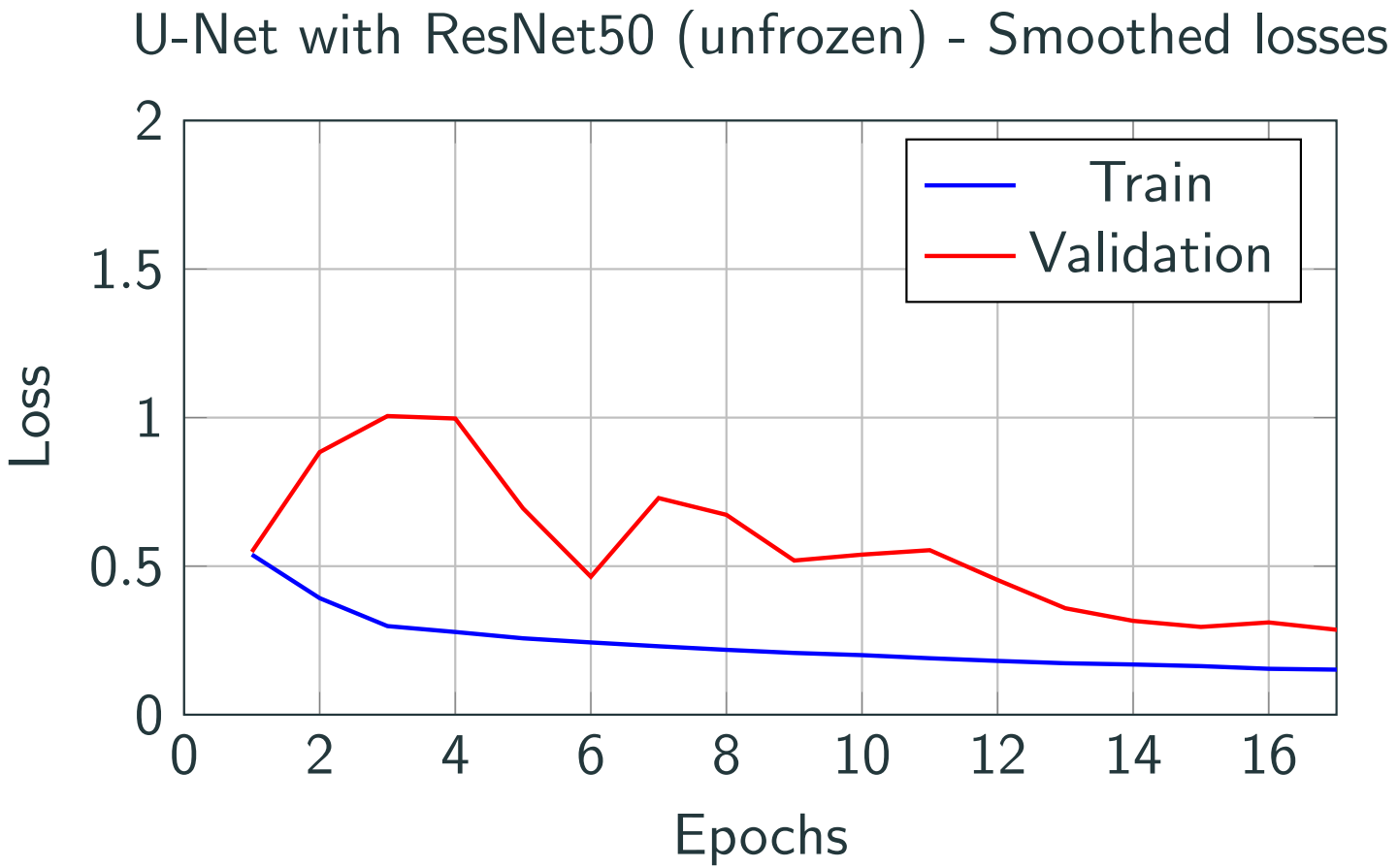

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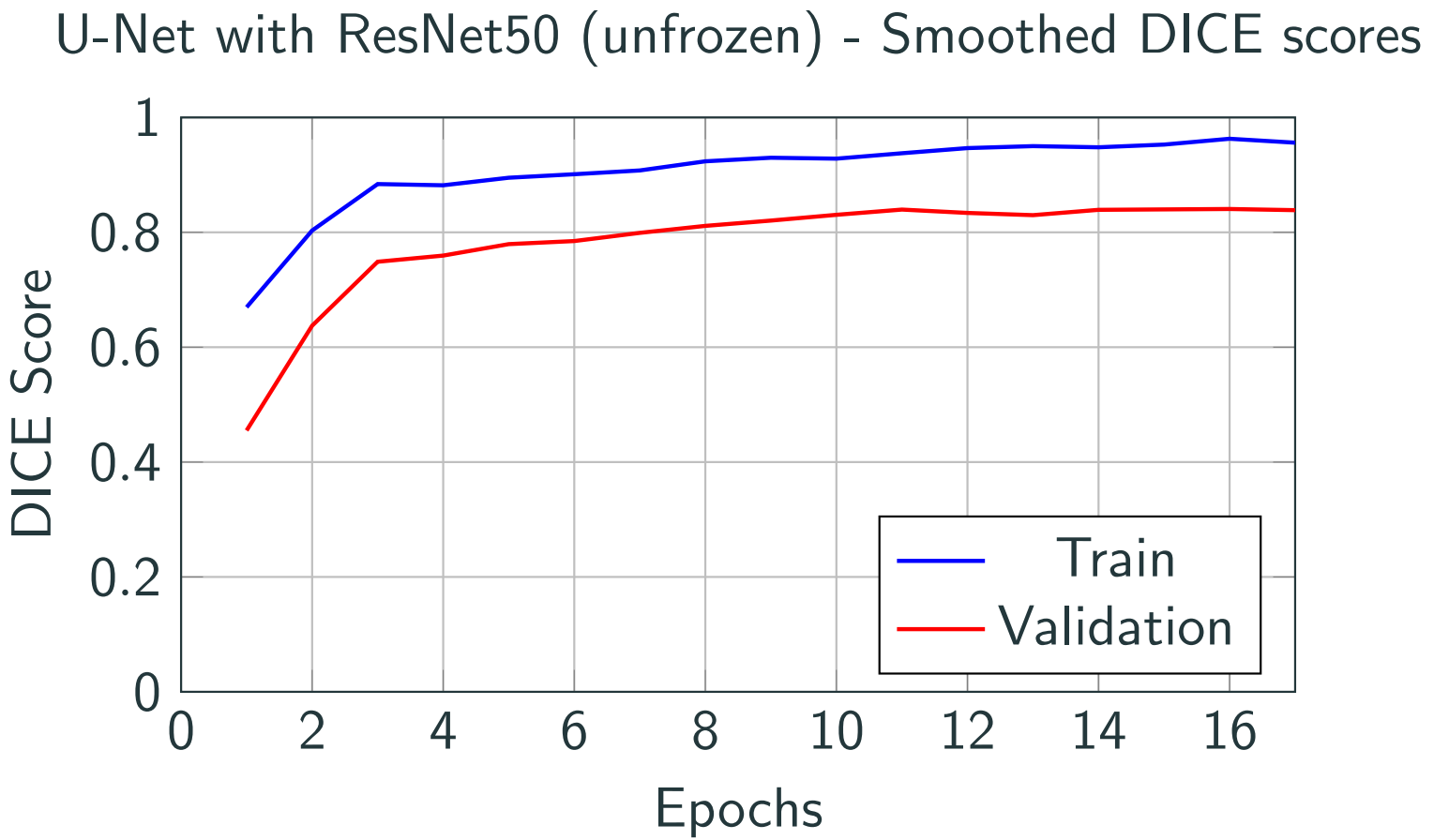
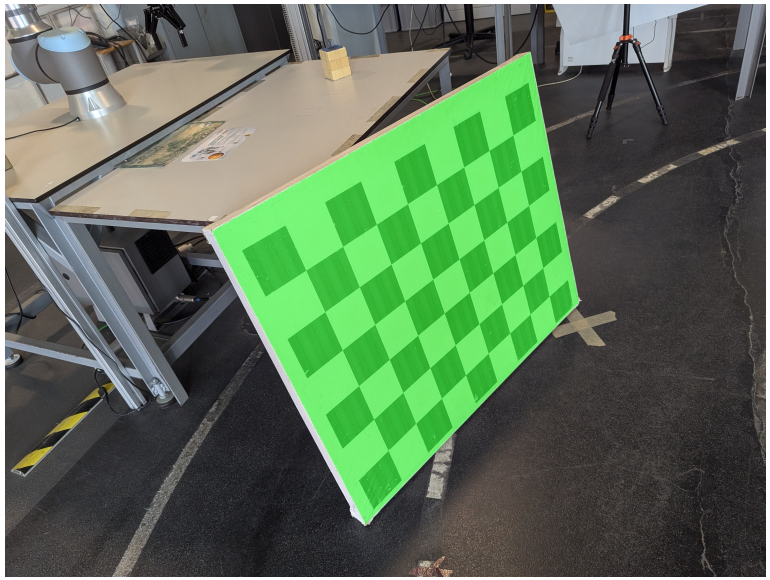
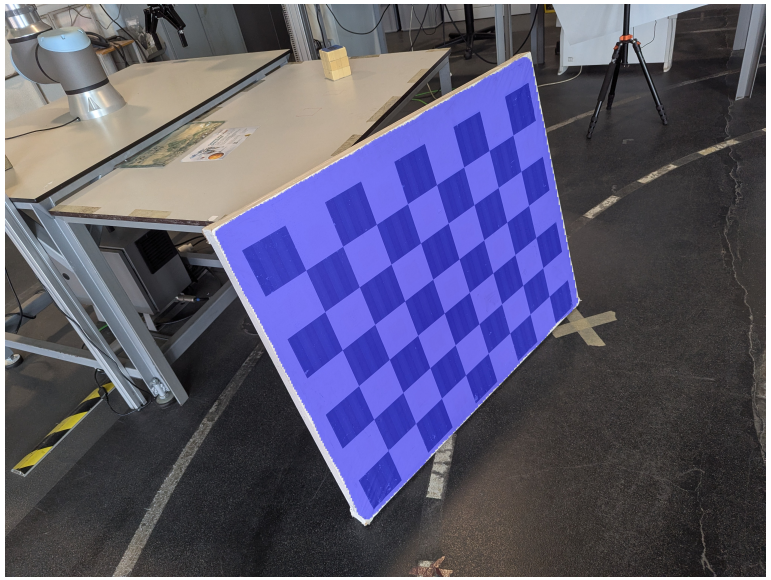


Alguns resultados do melhor modelo



Resultado esperado



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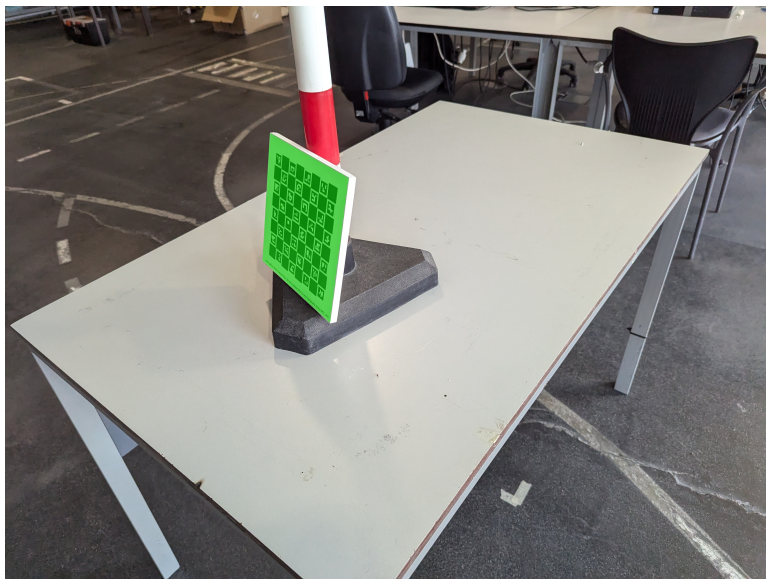

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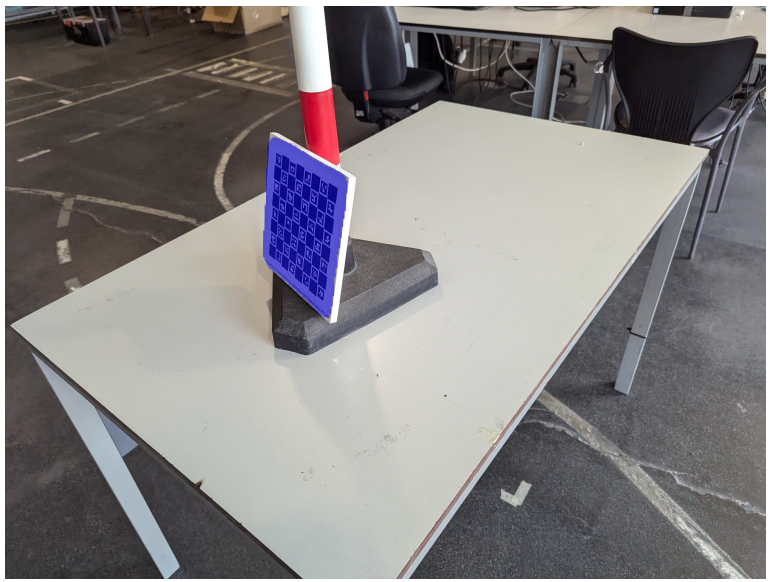

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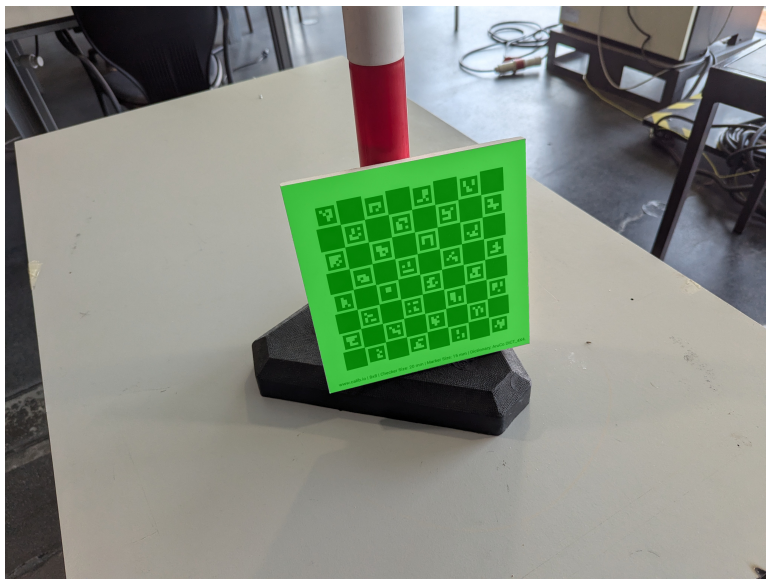

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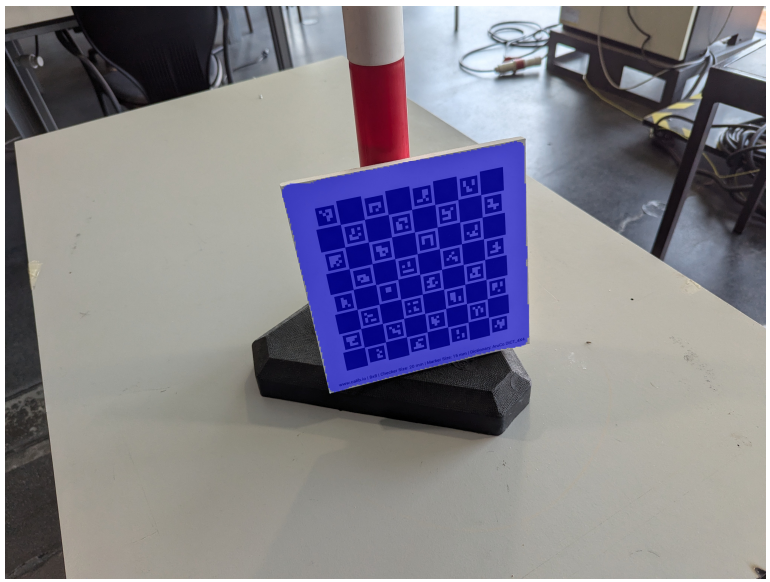

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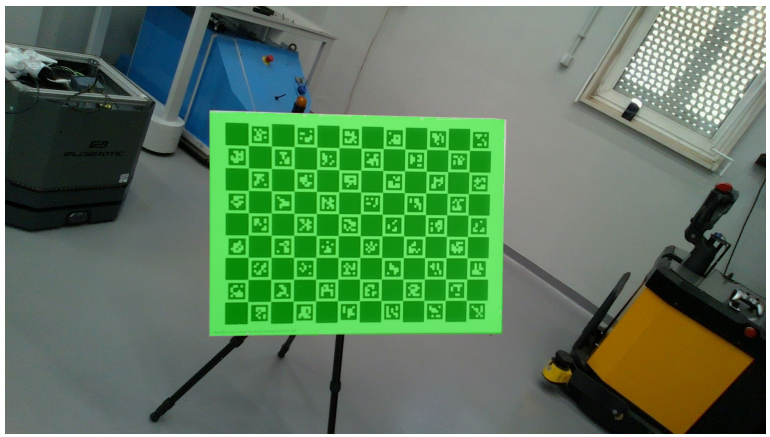

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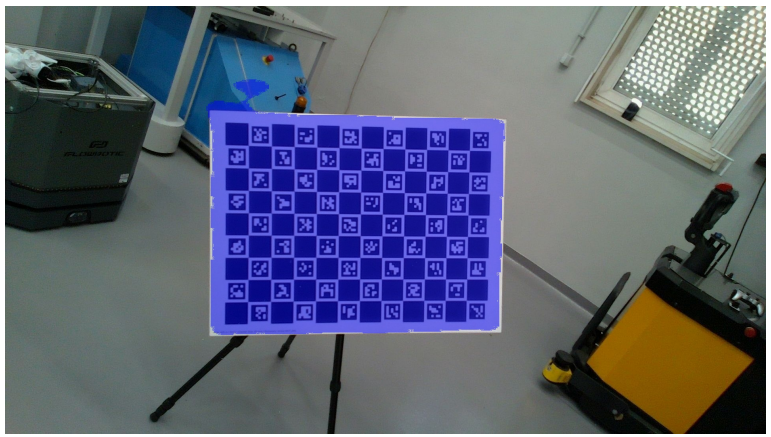

Resultado obtido

Conclusão

- The segmentation mask approach effectively overcomes the challenges of variable outputs and occluded corners in calibration pattern detection.
- U-Net models were successfully employed but exhibited overfitting due to dataset limitations.
- Using a pre-trained ResNet50 backbone improved performance
- This method streamlines the calibration evaluation process, reducing manual effort and improving overall usability.

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