

# Processamento Digital de Imagens

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Projeto

Arthur Flor  
Glauber Nascimento

# Conteúdo

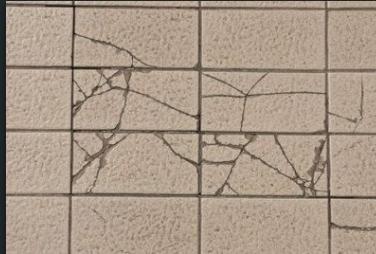
- Introdução
- Estudos Relacionados
- Abordagem
- Base de Dados
- PDI
- Deep Learning
- Resultados
- Conclusões

# Introdução

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# Projeto

Identificar rachaduras em imagens de cerâmica



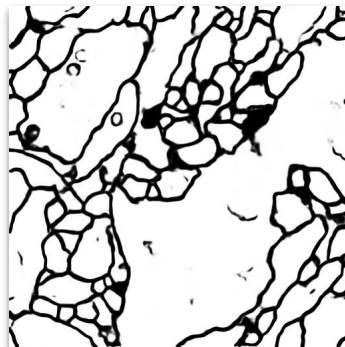
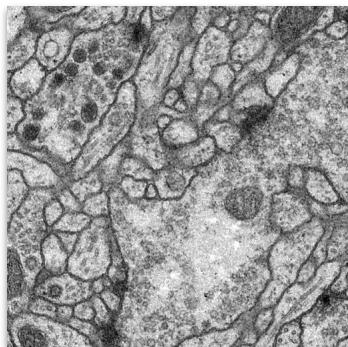
# Estudos Relacionados

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# Trabalhos de Artigos

## U-Net: Convolutional Networks for Biomedical Image Segmentation

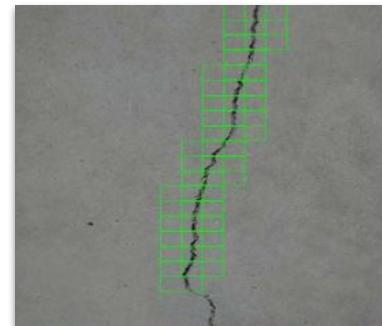
Olaf Ronneberger, Philipp Fischer e Thomas Brox  
(2015)



*Imagen original e segmentada.*  
Fonte: <https://github.com/zhiuhao/unet>

## Semantic Metric 3D Reconstruction for Concrete Inspection

Liang Yang, Bing Li, Wei Li, Biao Jiang e Jizhong Xiao (2018)



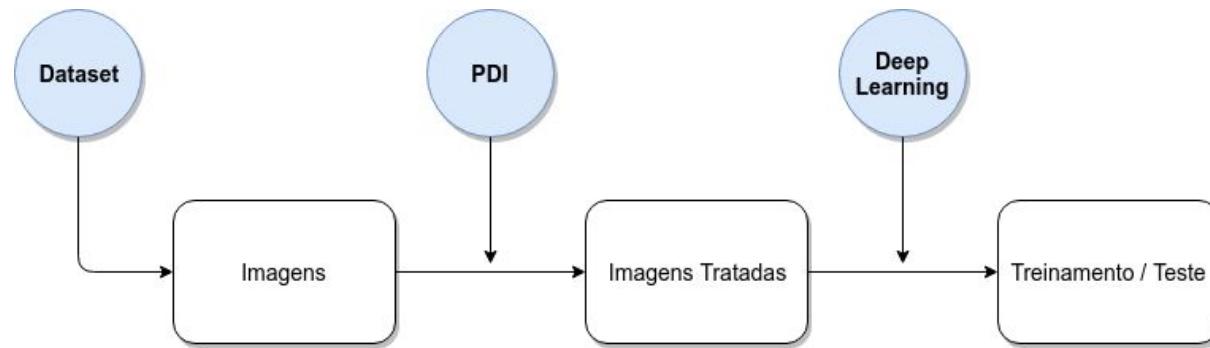
*Imagen original e segmentada.*  
Fonte: <https://ericlyang.github.io/project/deepinspection>

# Abordagem

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# Fluxograma do Projeto

- Projeto modularizado em Dataset, Pré-processamento e Arquitetura da Rede Neural.

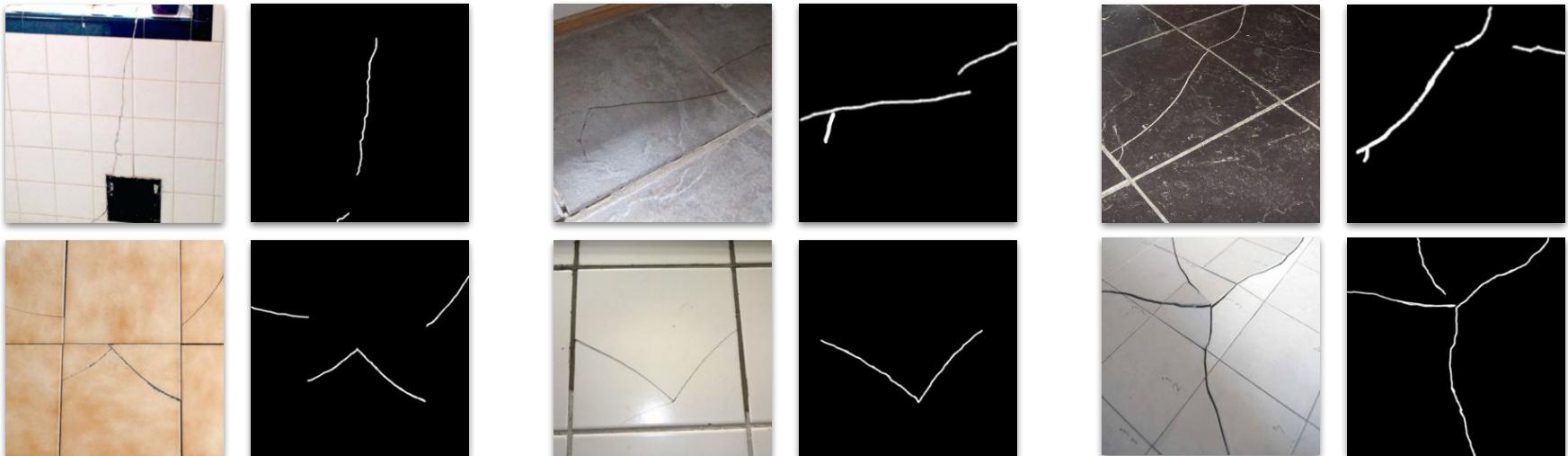


# Base de Dados

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# Dataset

- Dataset criado com 100 imagens de cerâmicas com rachaduras (256x256)
- Data Augmentation para 10.100 imagens



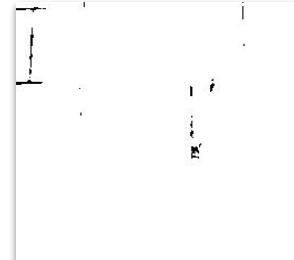
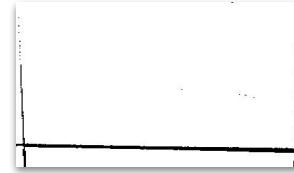
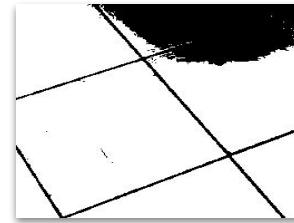
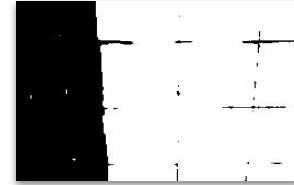
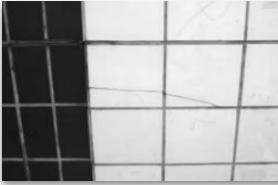
*Imagens do dataset e suas respectivas labels*

PDI

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# Pré-processamento

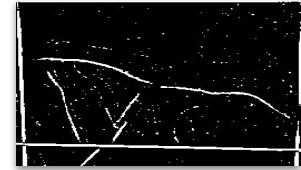
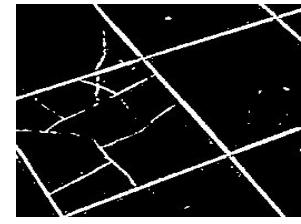
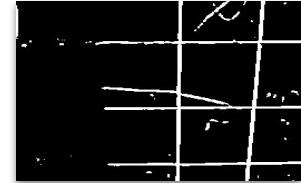
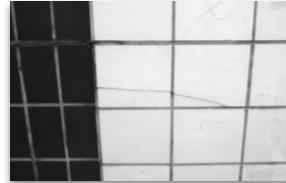
→ Binarização?



Imagens originais e binarizadas

# Pré-processamento

- Equalização da luz
- Filtro gaussiano (3x3)
- Ajuste de luz e contraste
- Inversão de cores (caso necessário)
- Erosão e dilatação (5x5)
- Binarização



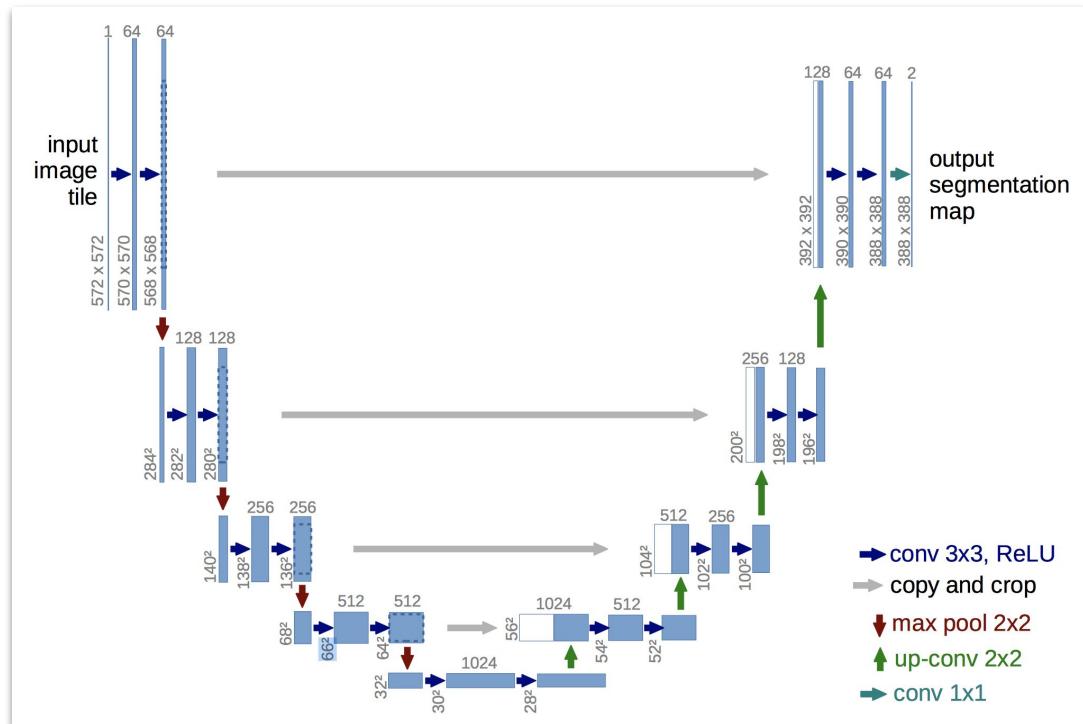
Imagens originais e tratadas

# Deep Learning

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# U-net

A U-net é uma arquitetura de rede convolucional para segmentação rápida e precisa de imagens, desenvolvida para a área de biomedicina.



Arquitetura da U-net.

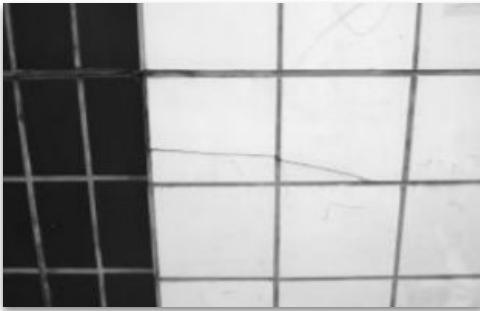
Fonte: <https://lmb.informatik.uni-freiburg.de/people/ronneber/u-net/>

# Resultados

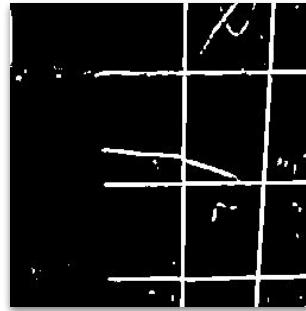
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# Segmentação

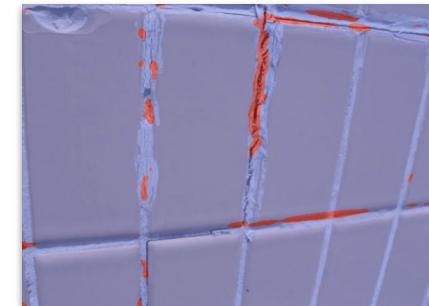
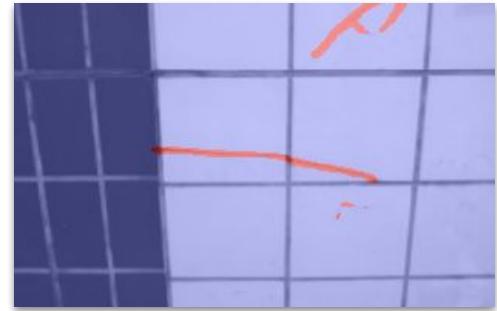
Original



Pré-processada



Segmentada



# Segmentação

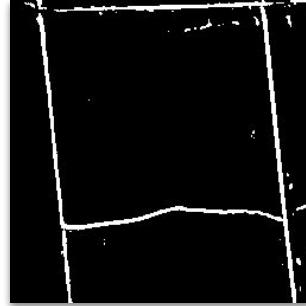
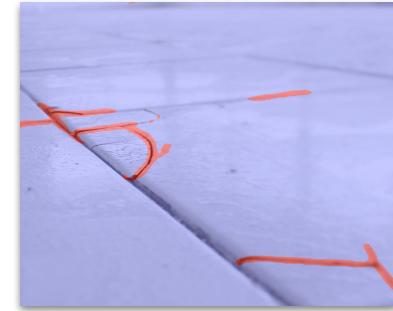
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Pré-processada



Segmentada

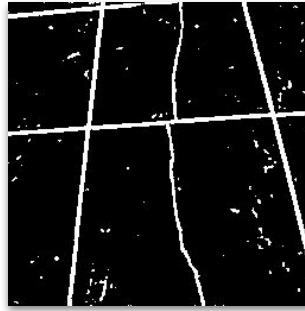


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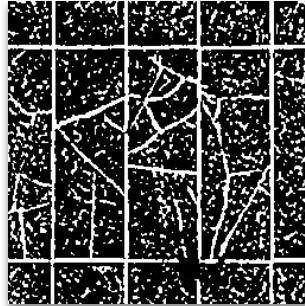
Original



Pré-processada



Segmentada

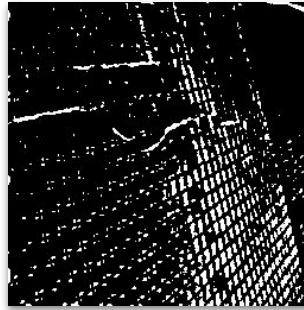


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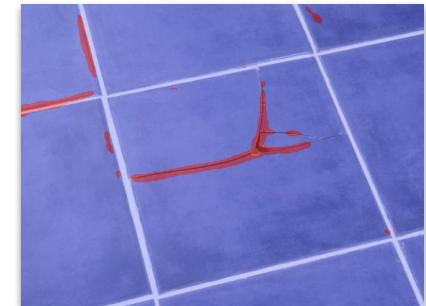
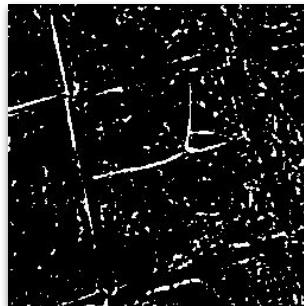
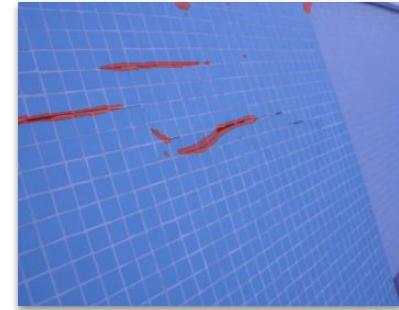
Original



Pré-processada



Segmentada

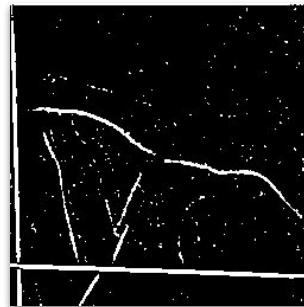


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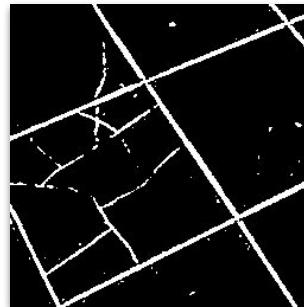
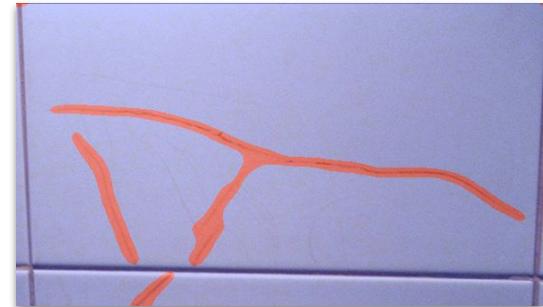
Original



Pré-processada



Segmentada



# Segmentação

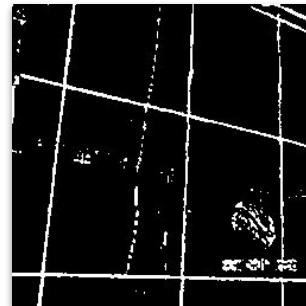
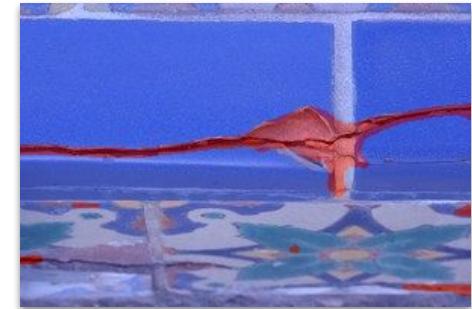
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Pré-processada



Segmentada



# Resultados - Erros

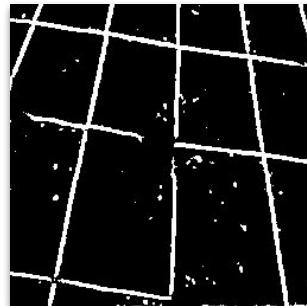
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# Segmentação - Erros

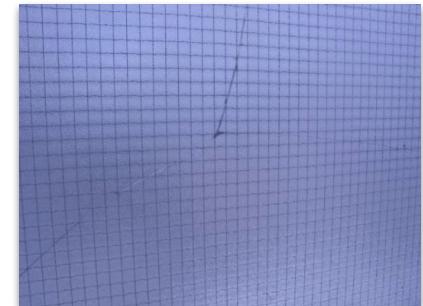
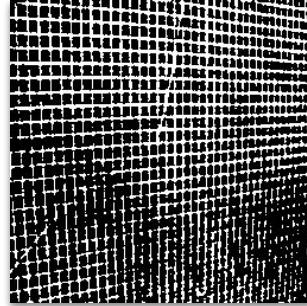
Original



Pré-processada



Segmentada

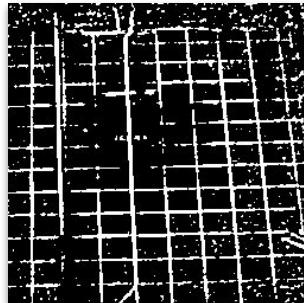
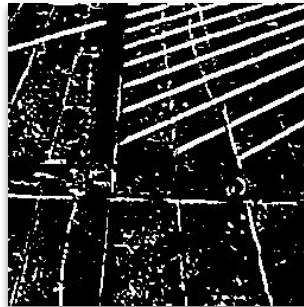


# Segmentação - Erros

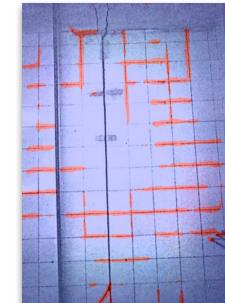
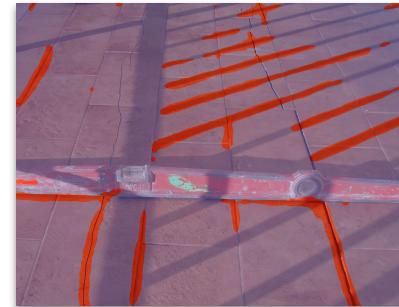
Original



Pré-processada



Segmentada

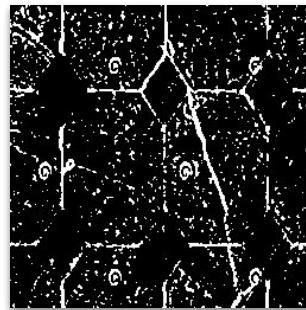


# Segmentação - Erros

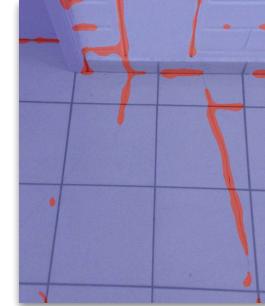
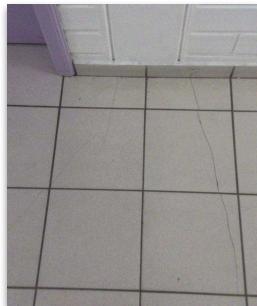
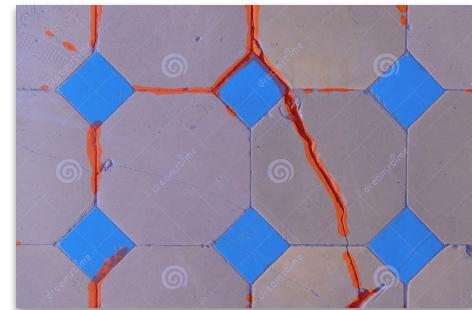
Original



Pré-processada



Segmentada



# Conclusões

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# Conclusões

- Dataset: quantidade e diversificação
- Imagens: uniformização e qualidade
- Pré-processamento: minimizar etapas
- Possibilidade de se trabalhar com outros cenários

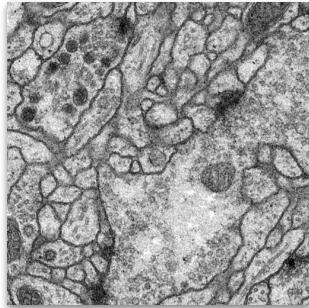
# Extra

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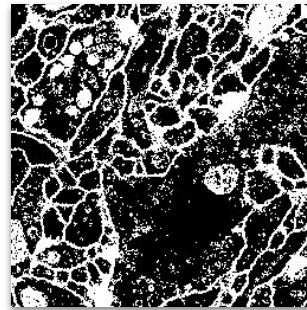
# Outras Detecções

Microscópio

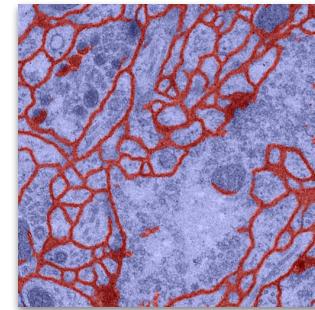
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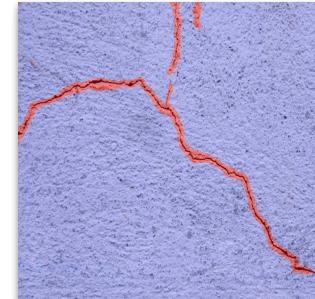
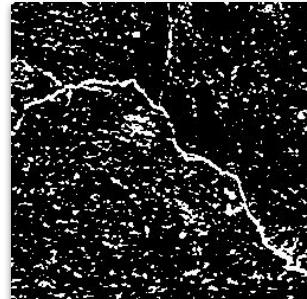
Pré-processada



Segmentada



Concreto



# Referências

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# Referências

- Cha, Y. , Choi, W. and Büyüköztürk, O. (2017) **Deep Learning-Based Crack Damage Detection Using Convolutional Neural Networks.** Computer-Aided Civil and Infrastructure Engineering, 32: 361-378.
- Liang Yang, Bing Li, Wei Li, Biao Jiang, Jizhong Xiao (2018) **Semantic Metric 3D Reconstruction for Concrete Inspection.** IEEE/CVF Conference on Computer Vision and Pattern Recognition Workshops.
- N. Coudray, A. Karathanou, S. Chambon (2010) **Multi-resolution approach for fine structure extraction - Application and validation on road images,** International Conference on Computer Vision Theory and Applications (VISAPP), Angers, France, 17-21.
- Ronneberger O., Fischer P., Brox T. (2015) **U-Net: Convolutional Networks for Biomedical Image Segmentation.** In: Navab N., Hornegger J., Wells W., Frangi A. (eds) Medical Image Computing and Computer-Assisted Intervention. Lecture Notes in Computer Science, vol 9351. Springer, Cham.
- Silva, W.R.L., Lucena, D.S. (2018) **Concrete Cracks Detection Based on Deep Learning Image Classification.** Proceedings, 2, 489.
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