MIPAR

Image Analysis Software

Titanium Characterization Demo

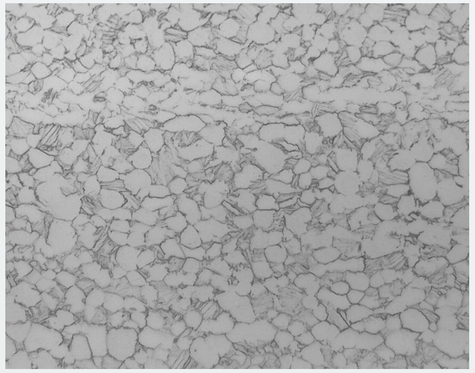
Globular Alpha, Laths, Colonies, Grain Boundary Alpha, Beta Grains

Simple. Uniquely Powerful.

Key Applications

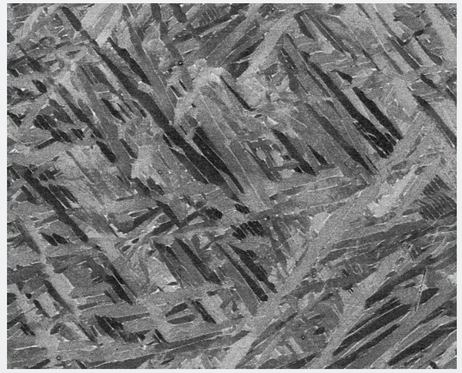
Globular Alpha

Globular particle size and volume fraction



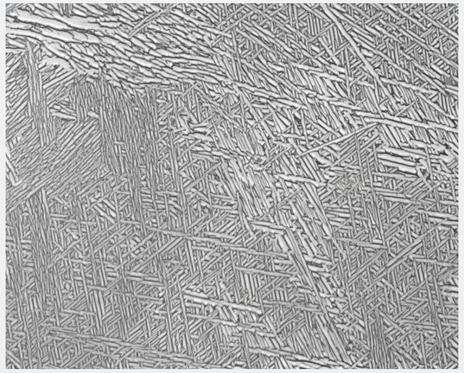
Alpha Laths

Lath thickness and alpha/beta volume fraction



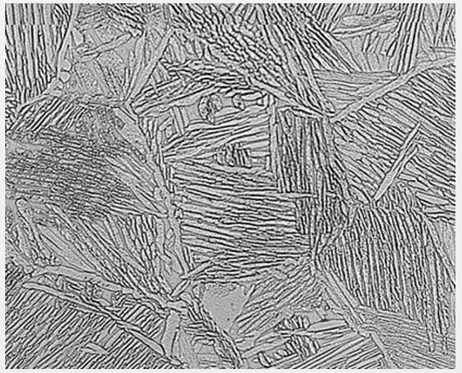
Colony Alpha

Colony vs. basketweave volume fraction, colony size measurement



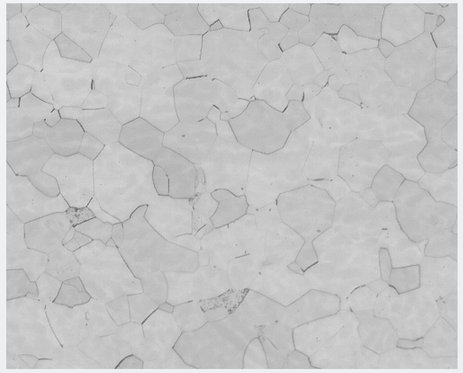
GB Alpha

Grain boundary alpha volume fraction and thickness



Beta Grains

Beta mean grain size and distribution



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Globular Alpha: Optical

Globular

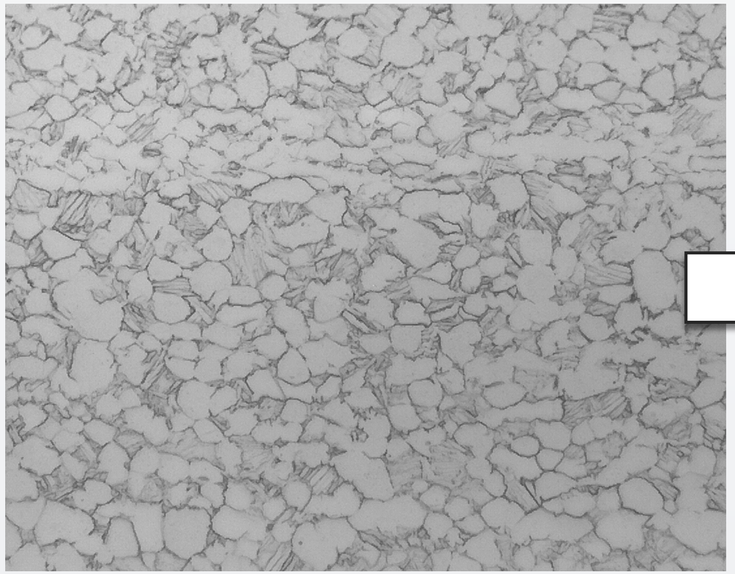
Laths

Colonies

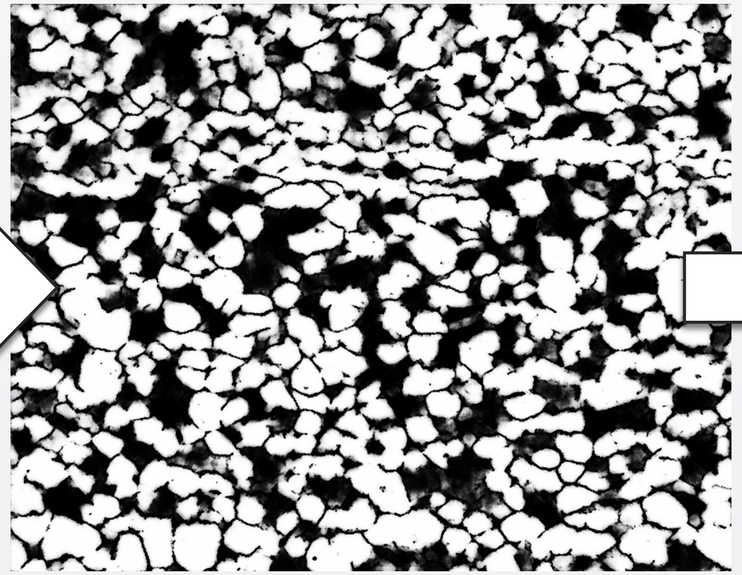
GB Alpha

Grains

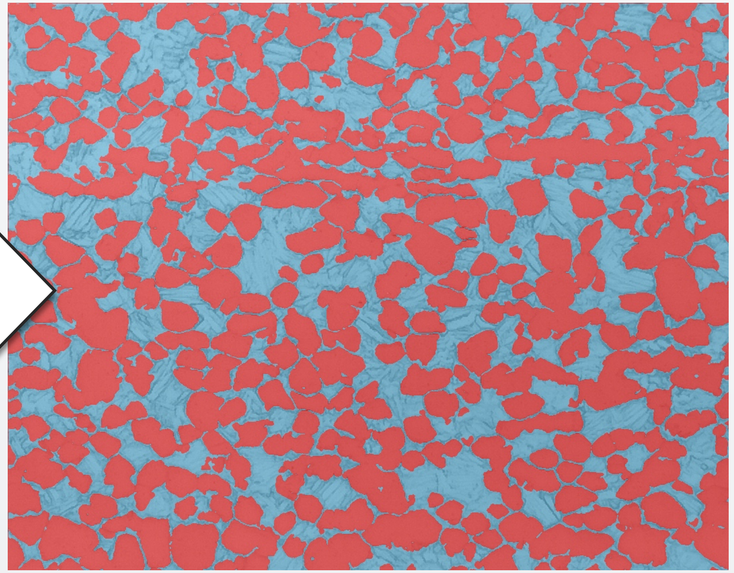
Original Image



Deep Learning Applied



Final Segmentation



GLOBULAR FRACTION: **61%**

- ✓ Model accurately detects globular alpha
- ✓ Avoids false positives in challenging transformation regions
- ✓ Globular percentage and size measurements possible

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Globular Alpha: SEM

Globular

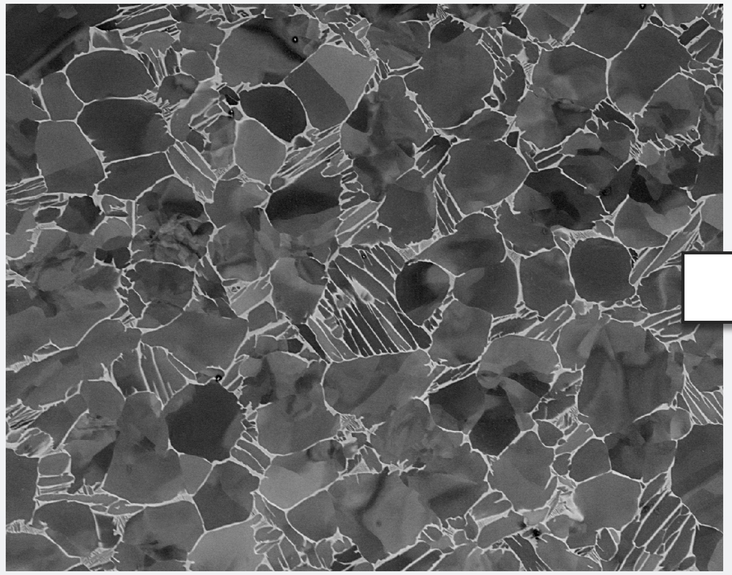
Laths

Colonies

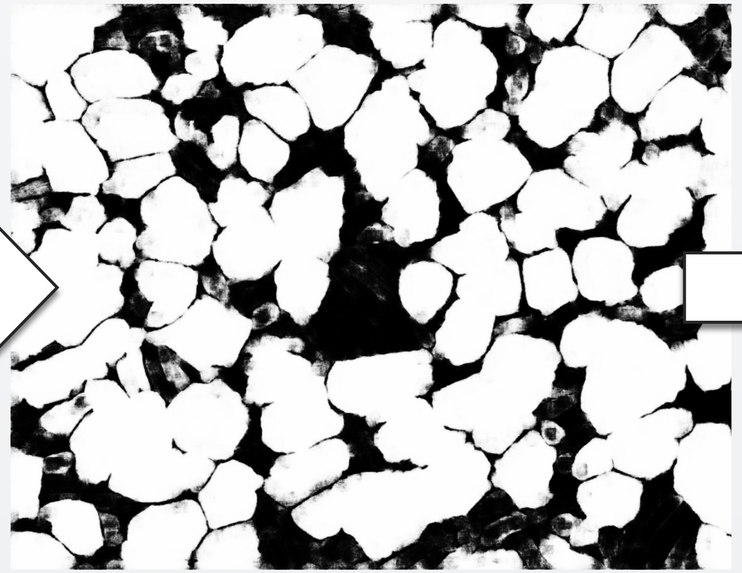
GB Alpha

Grains

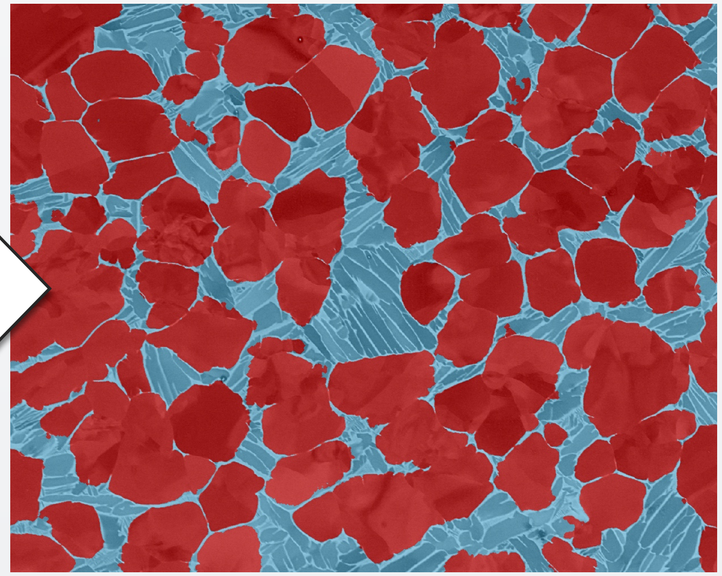
Original Image



Deep Learning Applied



Final Segmentation



GLOBULAR FRACTION: **72%**

- ✓ Model trained in **20 mins on GPU** (3.5 hours on CPU)
- ✓ Model applied to new image in **1 sec on GPU** (10 sec on CPU)

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Alpha Laths: Width

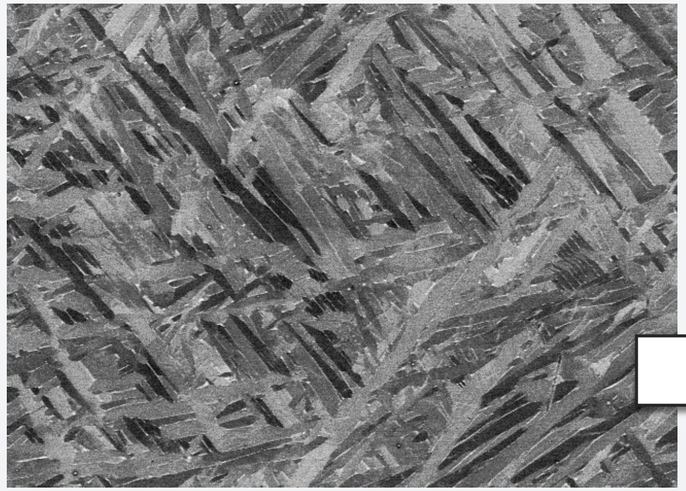
Globular

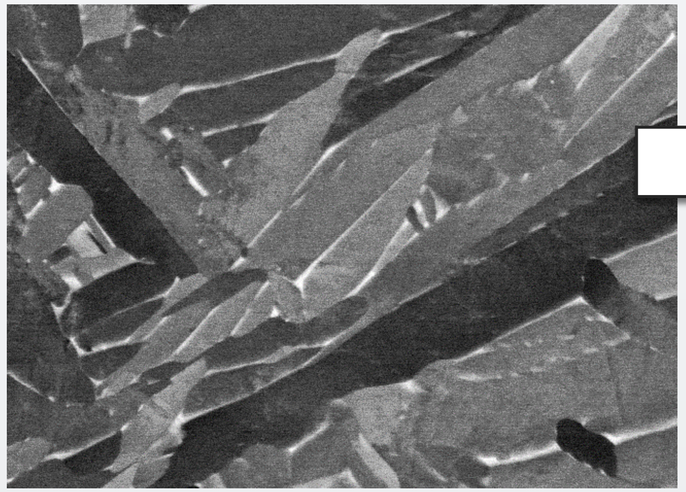
Laths

Colonies

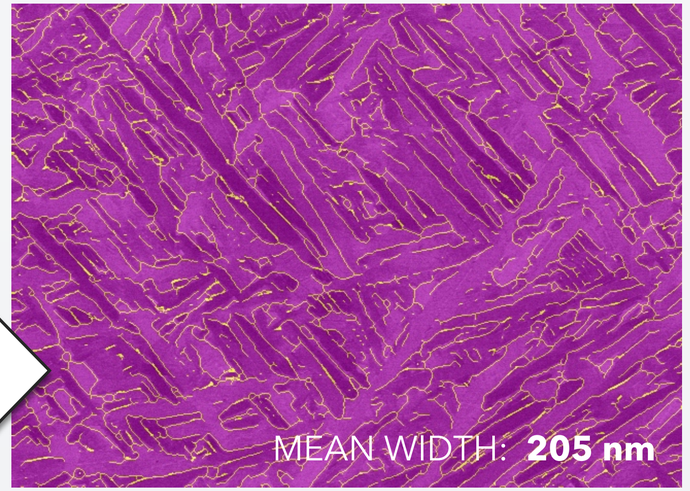
GB Alpha

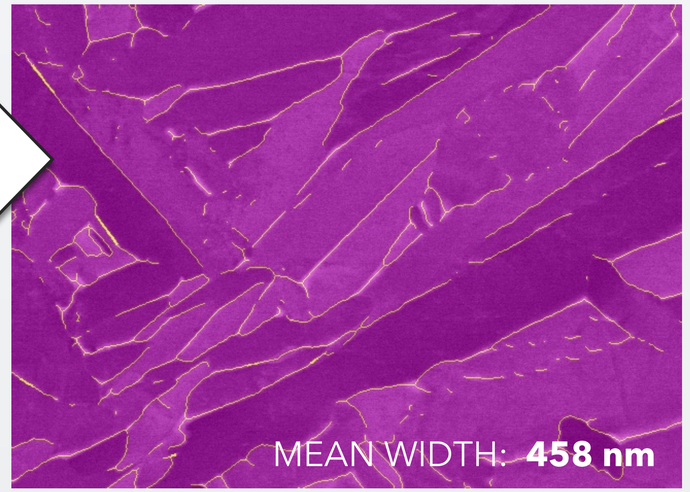
Grains





Deep Learning Model #1





- ✓ Identical algorithm works on different length scales
- ✓ Lath width measured via *Gundersen approximation*

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Alpha Laths: Phase Fraction

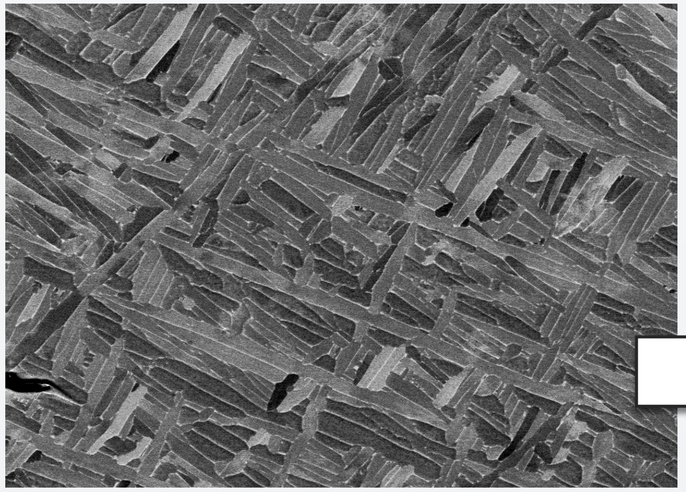
Globular

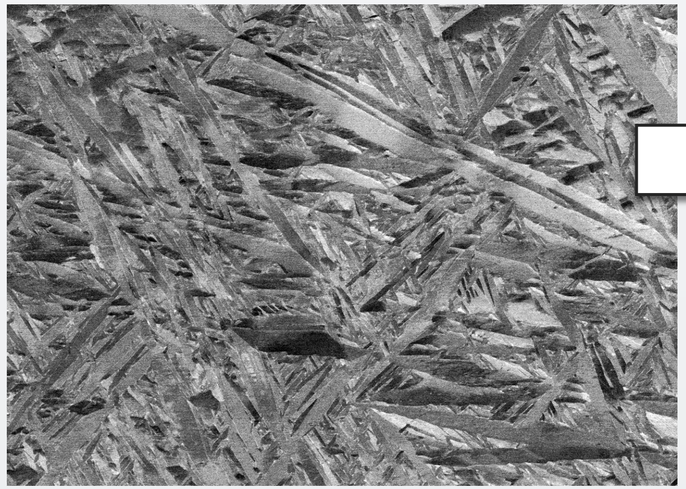
Laths

Colonies

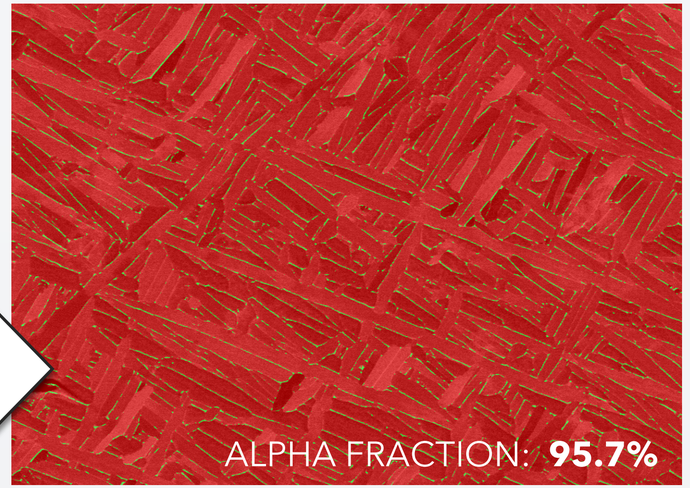
GB Alpha

Grains





Deep Learning Model #2



- ✓ Identical algorithm accurately detects alpha/beta phases
- ✓ Phase fraction measurements possible

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Colony Alpha: Colony vs. Basketweave Percentage

Globular

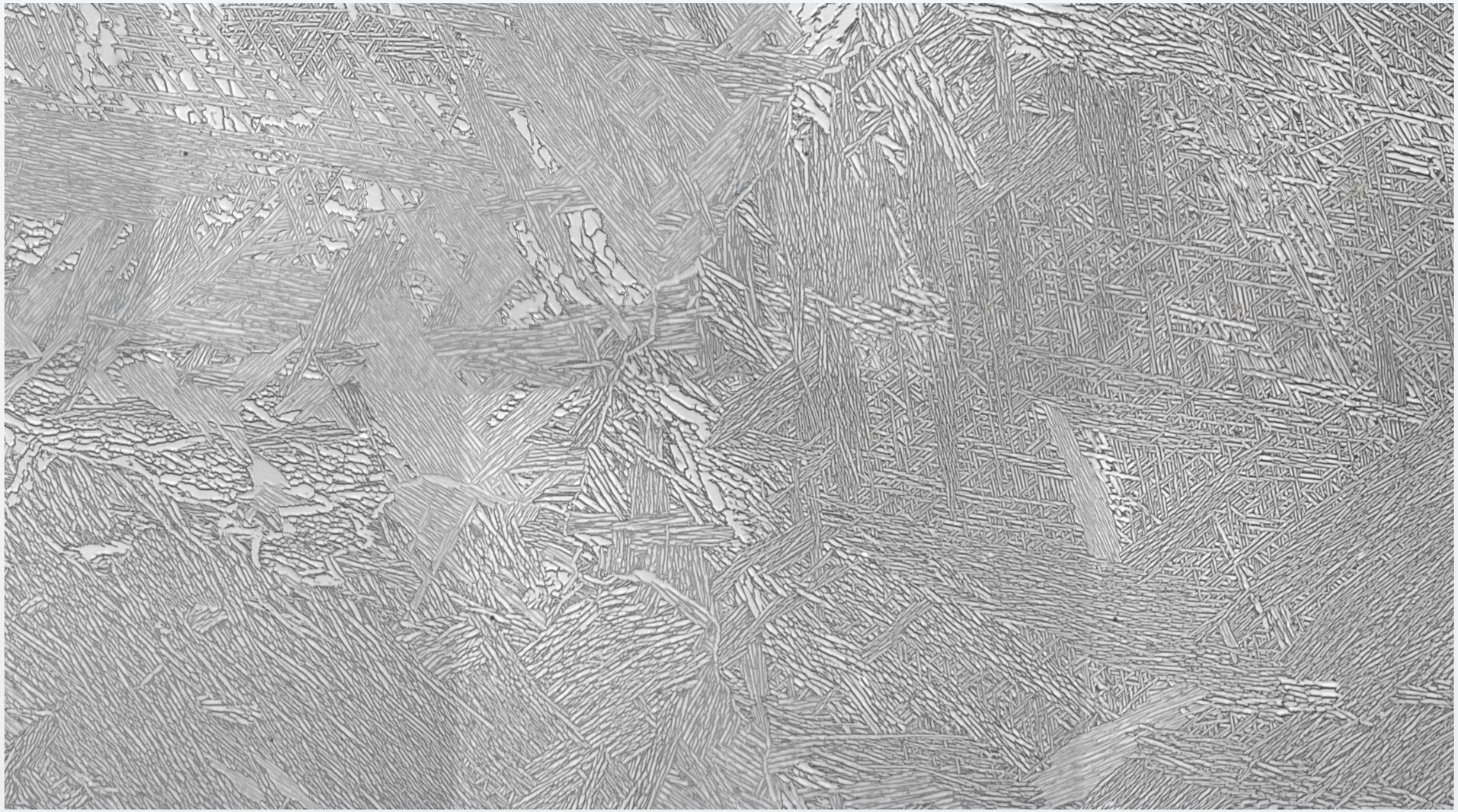
Laths

Colonies

GB Alpha

Grains

Original Image



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Colony Alpha: Colony vs. Basketweave Percentage

Globular

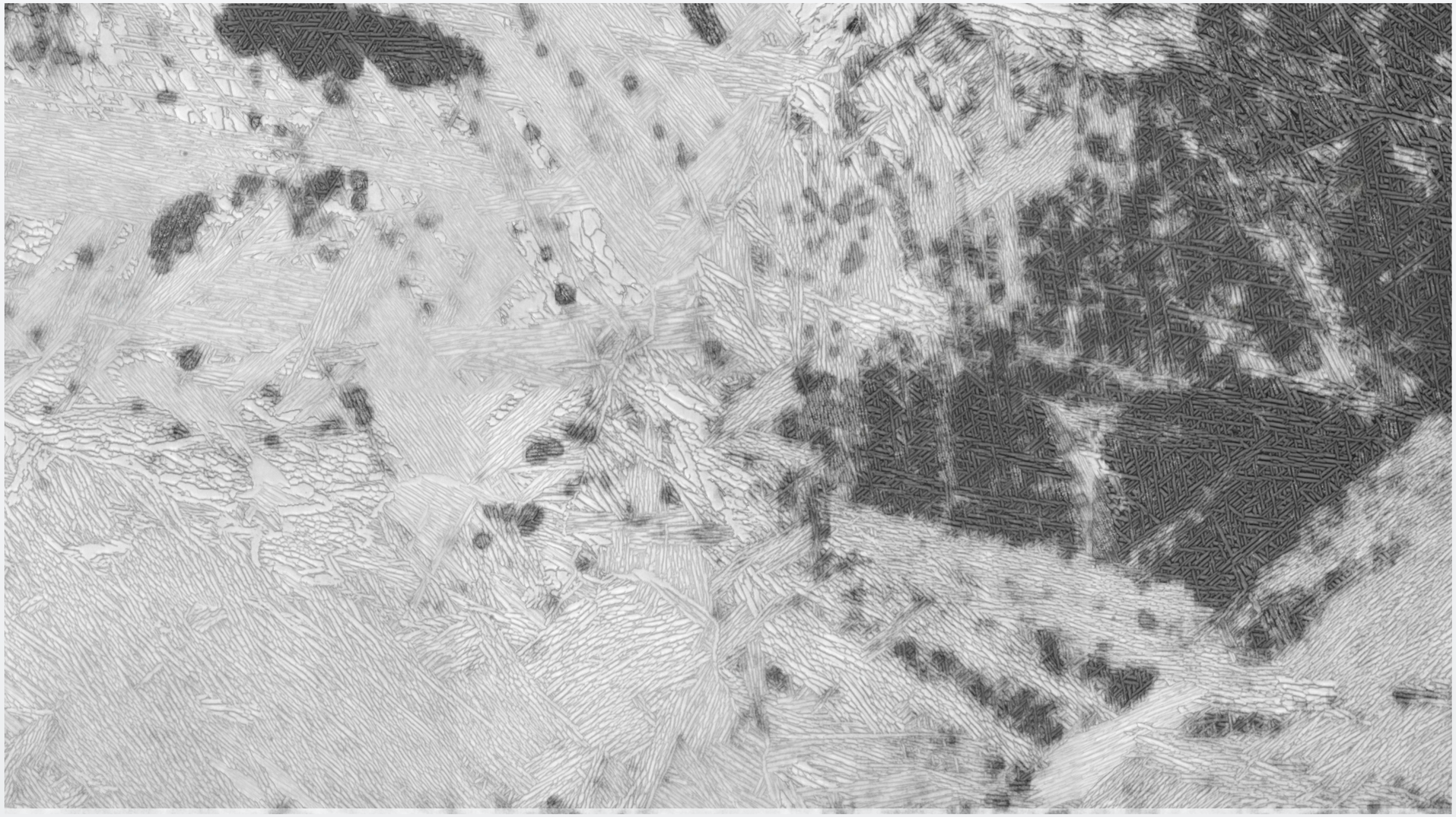
Laths

Colonies

GB Alpha

Grains

Deep Learning Applied



✓ Bright areas = Likely colony

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Colony Alpha: Colony vs. Basketweave Percentage

Globular

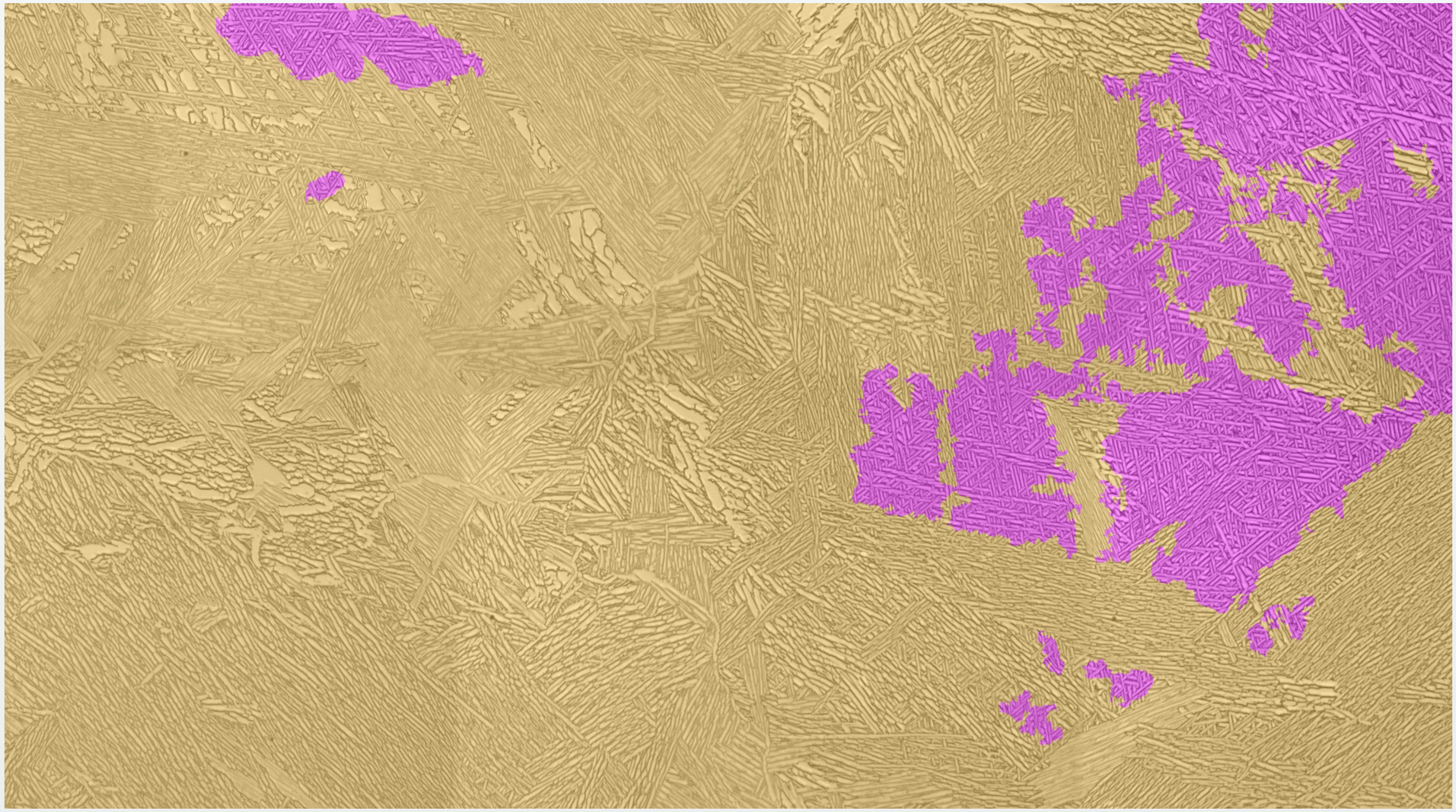
Laths

Colonies

GB Alpha

Grains

Segmentation



BASKETWEAVE

COLONY

✓ Deep learning enables highly complex classification

BASKETWEAVE FRACTION: **15%**

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Colony Alpha: Colony vs. Basketweave Percentage

Globular

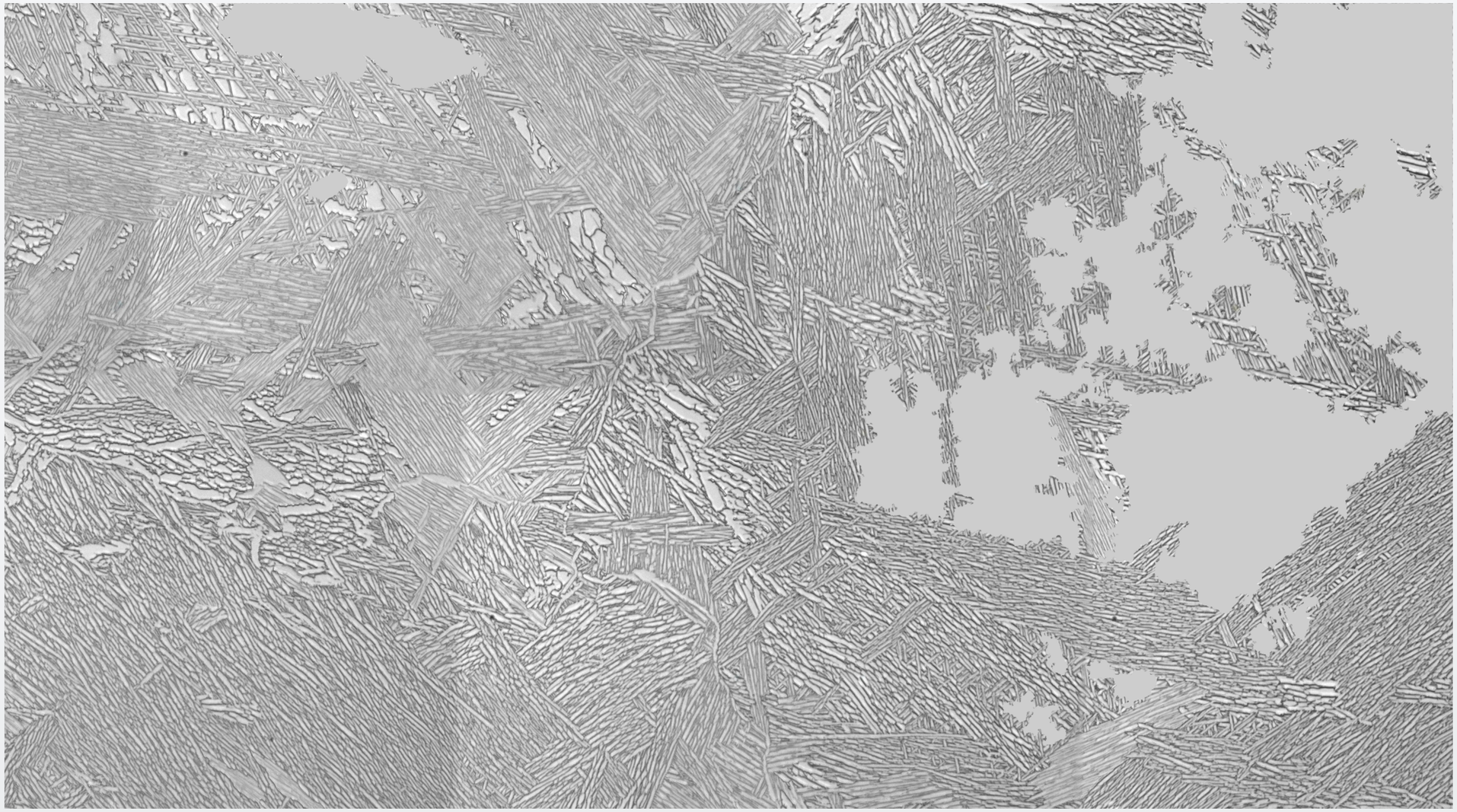
Laths

Colonies

GB Alpha

Grains

Original Image



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Colony Alpha: Colony Orientation and Size

Globular

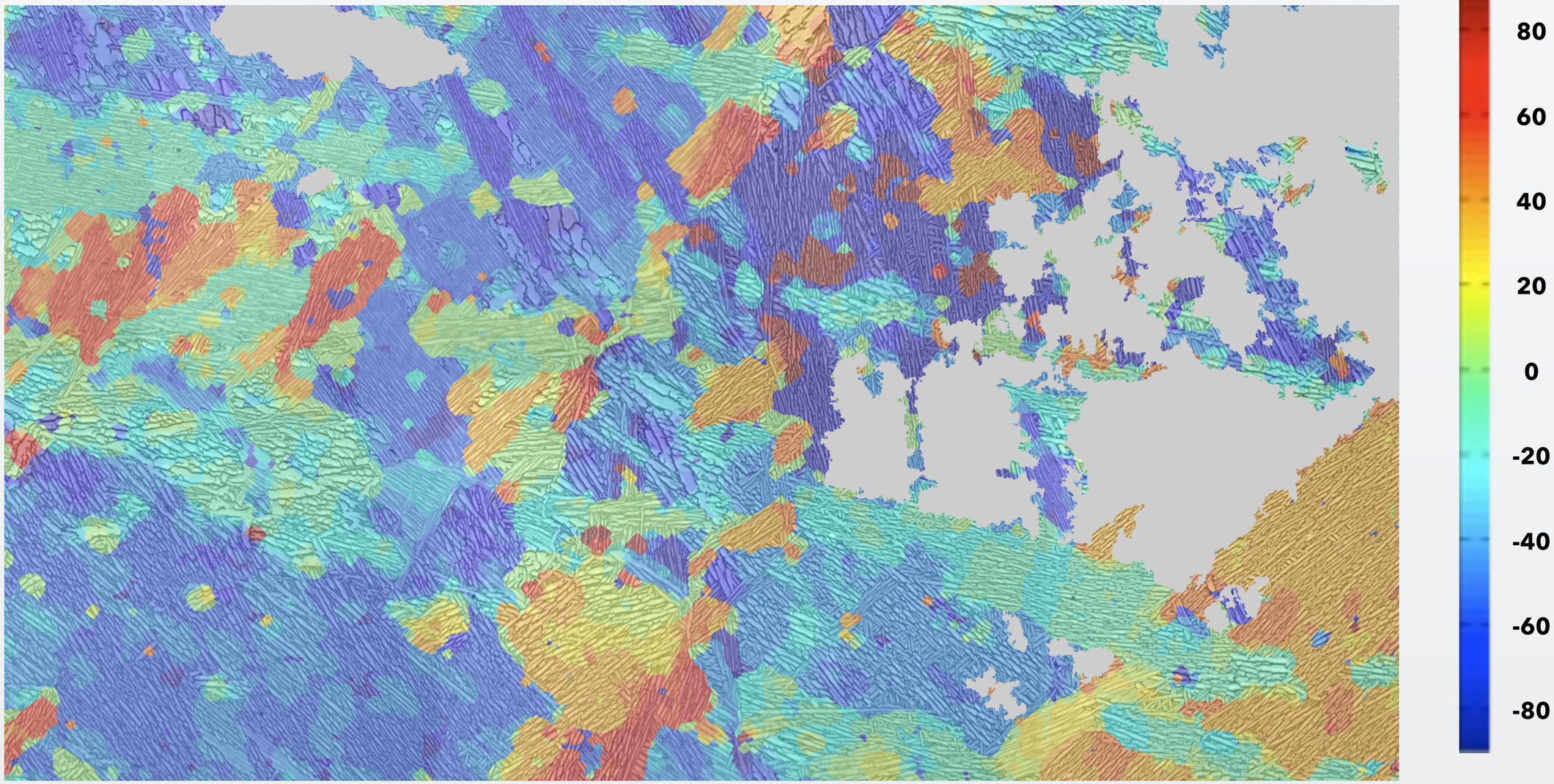
Laths

Colonies

GB Alpha

Grains

Orientation Map



✓ Pattern Mapping enables colony orientation quantification and size

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Grain Boundary Alpha: Percentage and Thickness

Globular

Laths

Colonies

GB Alpha

Grains

Original Image

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Image Analysis Software

Grain Boundary Alpha: Percentage and Thickness

Globular

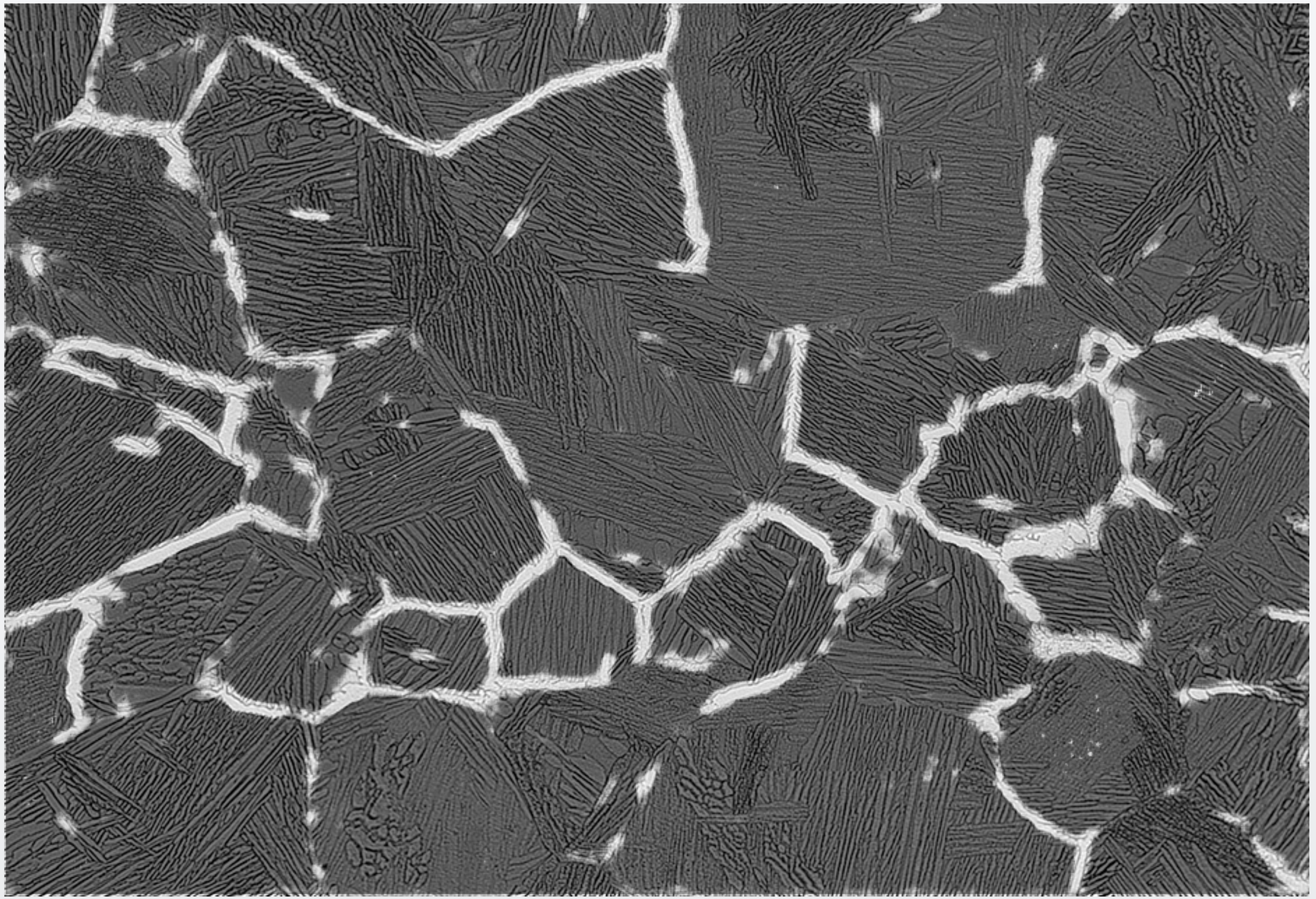
Laths

Colonies

GB Alpha

Grains

Deep Learning Applied



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Grain Boundary Alpha: Percentage and Thickness

Globular

Laths

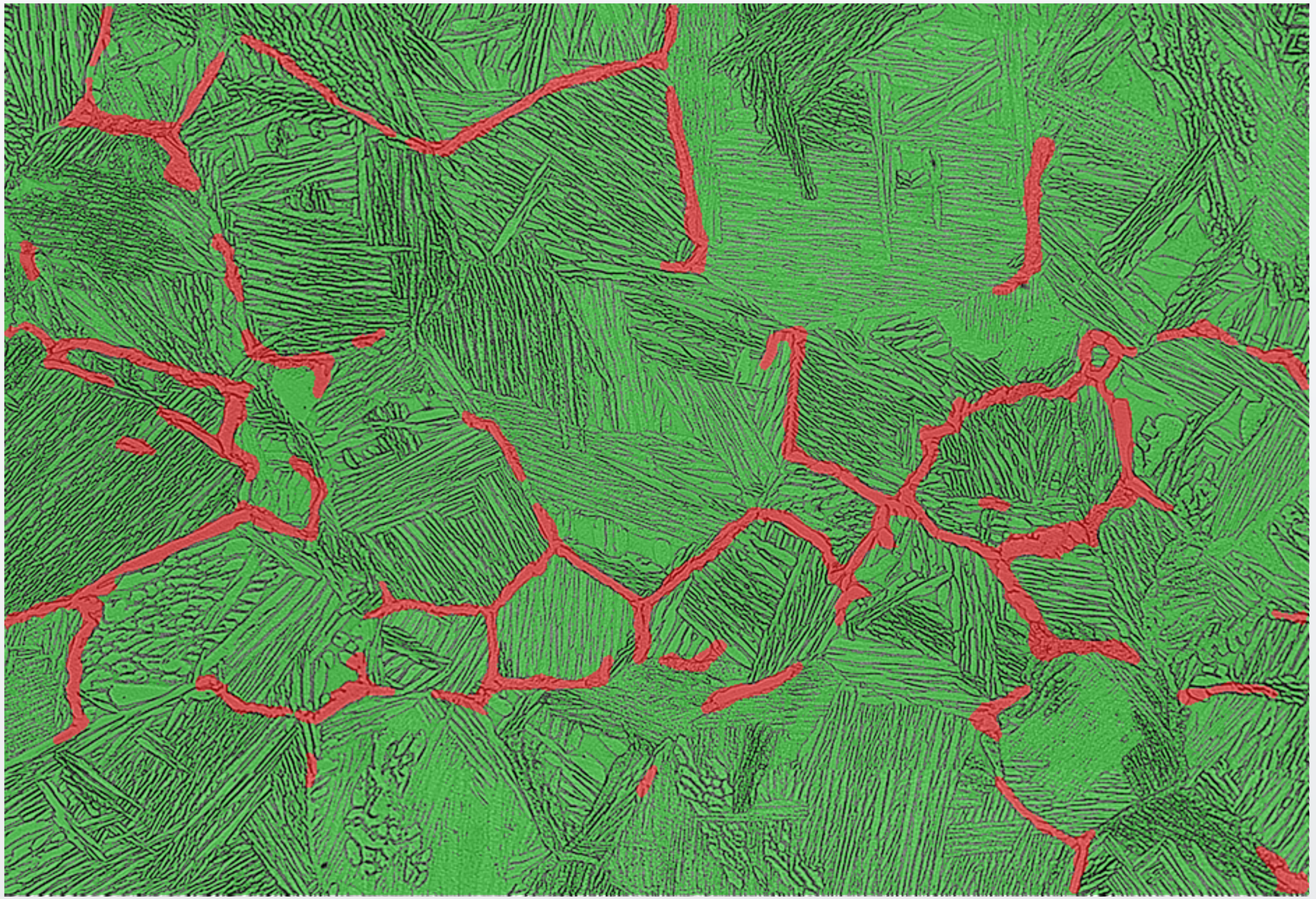
Colonies

GB Alpha

Grains

GB Alpha Detected

GB ALPHA FRACTION: **8%**



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Grain Boundary Alpha: Percentage and Thickness

Globular

Laths

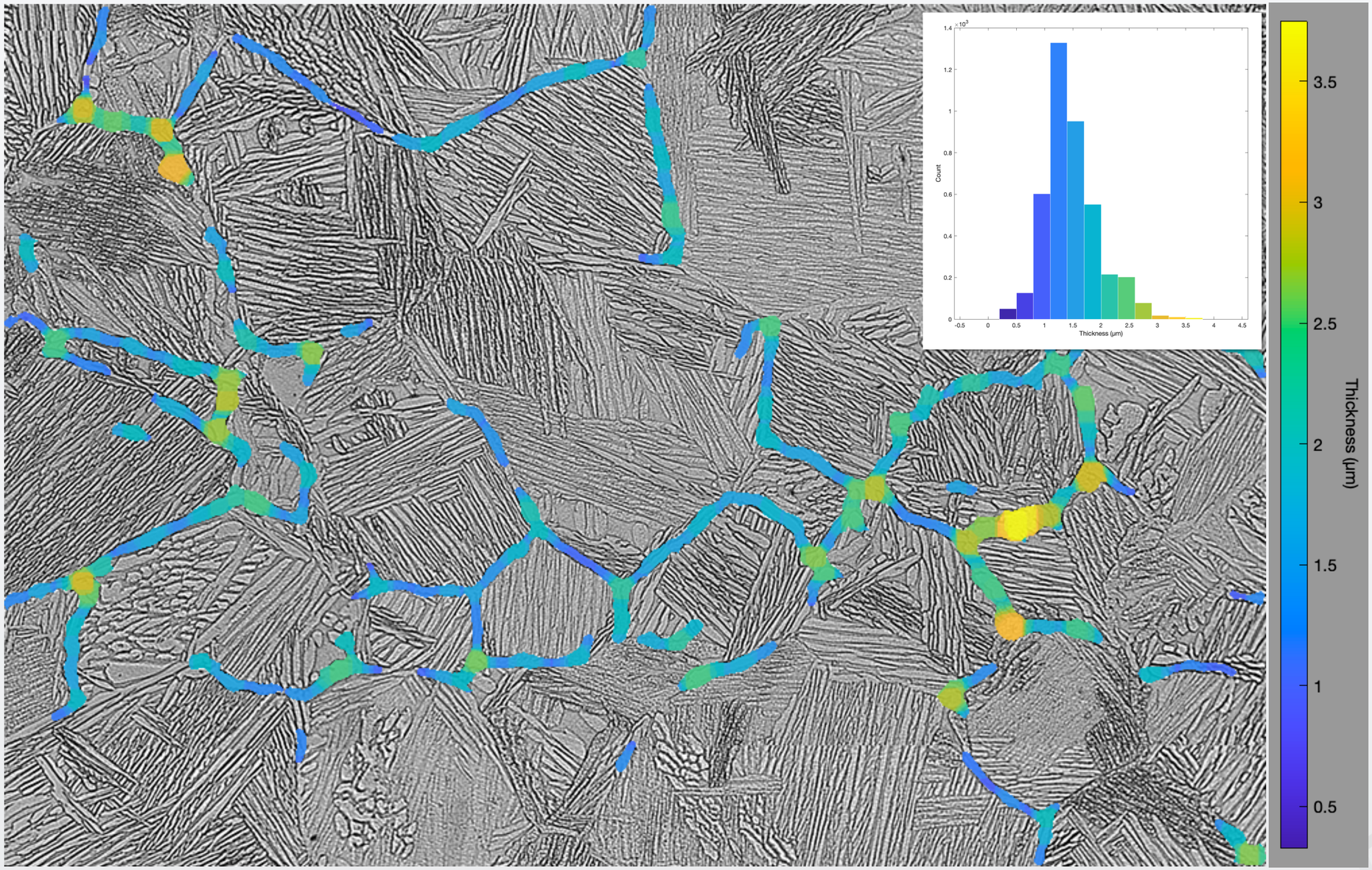
Colonies

GB Alpha

Grains

GB Alpha Thickness

MEAN THICKNESS: **1.5 µm**



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Beta Grains: Size

Globular

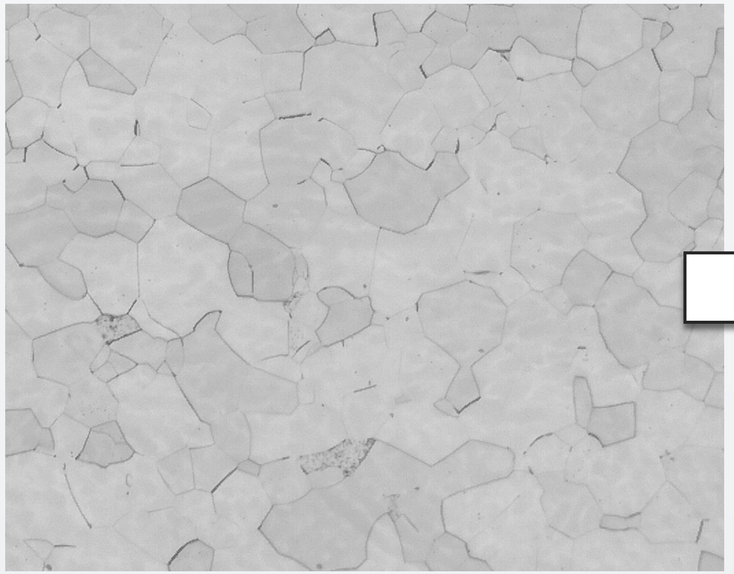
Laths

Colonies

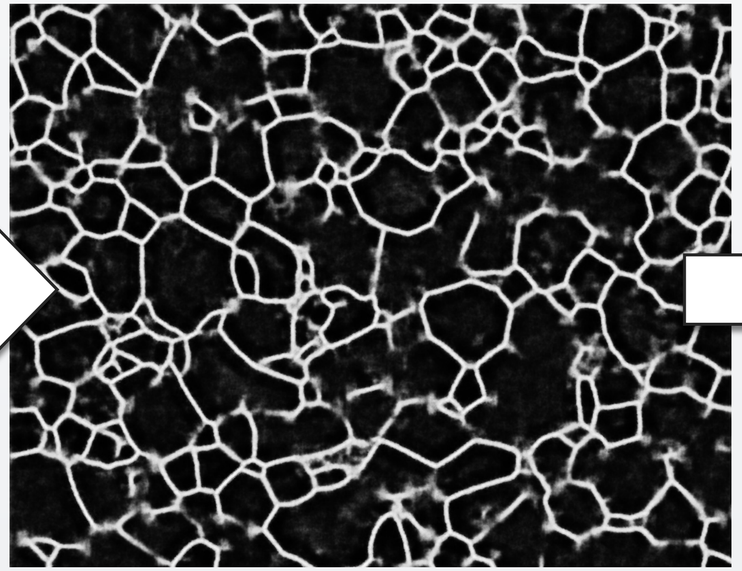
GB Alpha

Grains

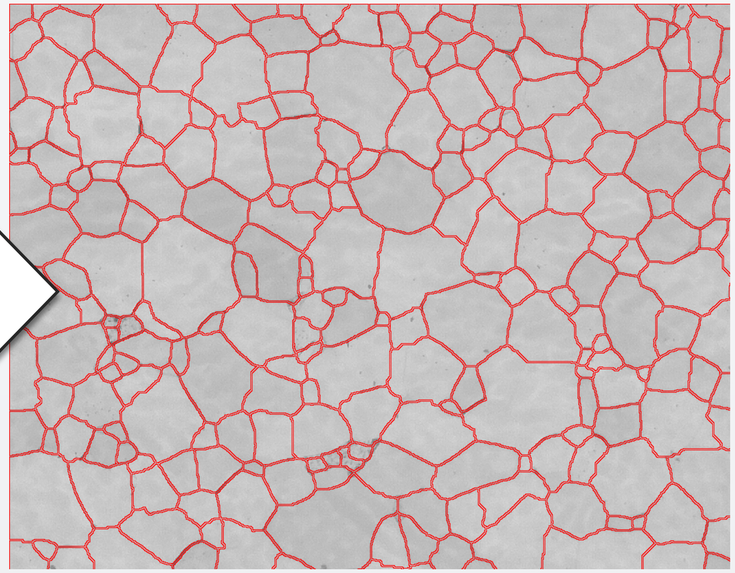
Original Image



Deep Learning Applied



Final Segmentation



- ✓ Accurately detects beta grains despite very faint contrast
- ✓ Grain mean size and distribution measurements possible

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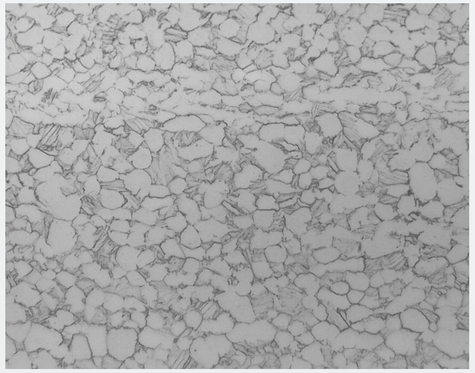
Key Applications

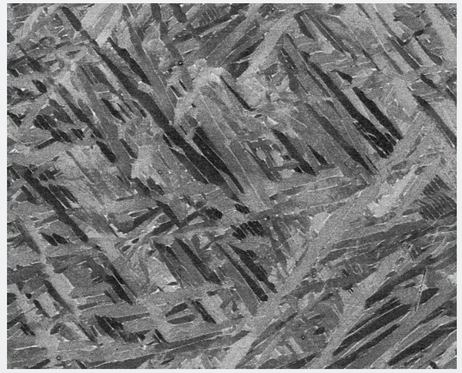
Globular Alpha

Globular particle size and volume fraction



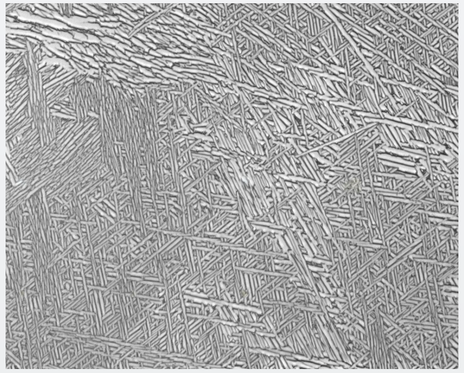
Alpha Laths

Lath thickness and alpha/beta volume fraction



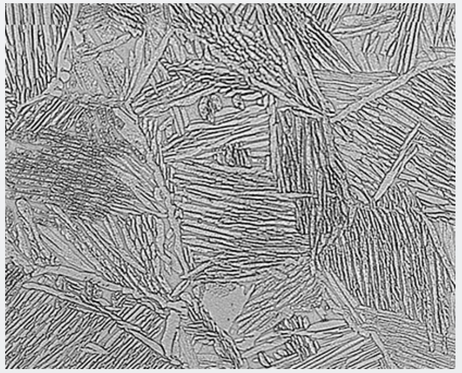
Colony Alpha

Colony vs. basketweave volume fraction, colony size measurement



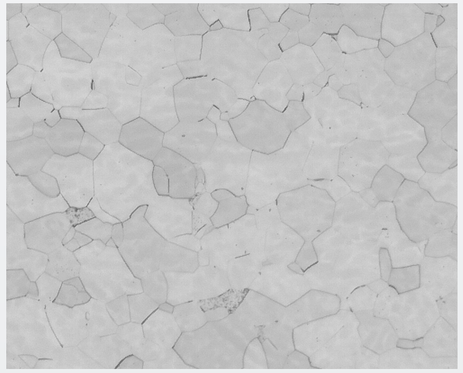
GB Alpha

Grain boundary alpha volume fraction and thickness



Beta Grains

Beta mean grain size and distribution



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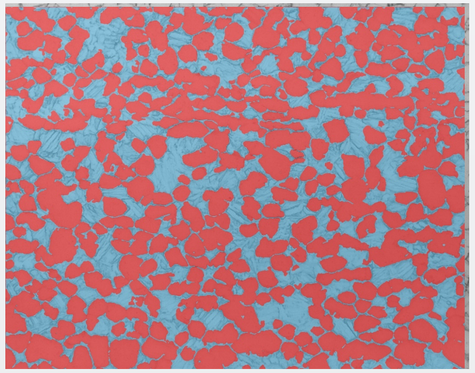
Key Applications

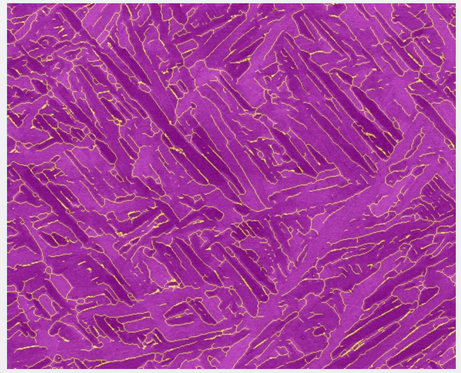
Globular Alpha

Globular particle size and volume fraction



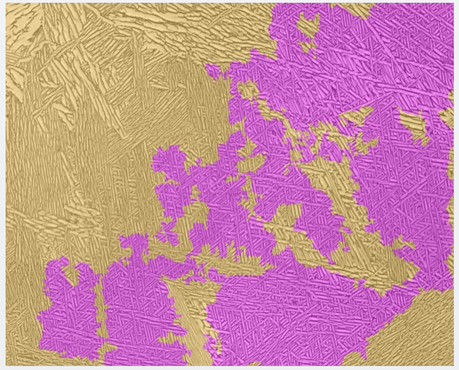
Alpha Laths

Lath thickness and alpha/beta volume fraction



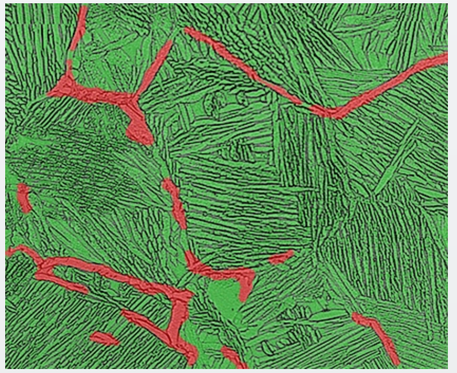
Colony Alpha

Colony vs. basketweave volume fraction, colony size measurement



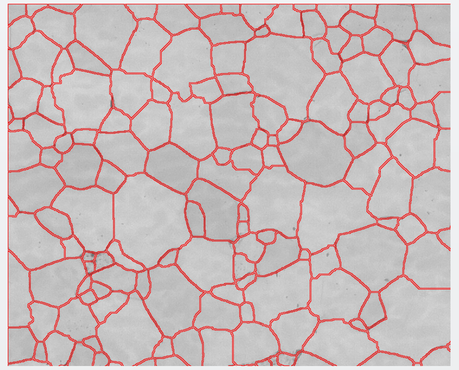
GB Alpha

Grain boundary alpha volume fraction and thickness



Beta Grains

Beta mean grain size and distribution



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