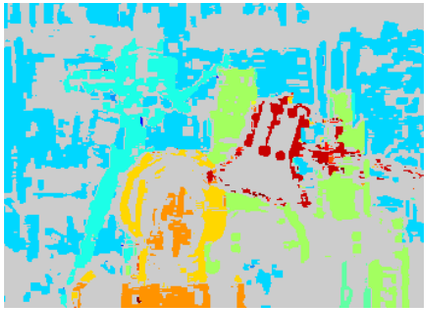
How confidence interval is estimated

Confidence interval is $\big[c - \Delta,\, c\big]$, where

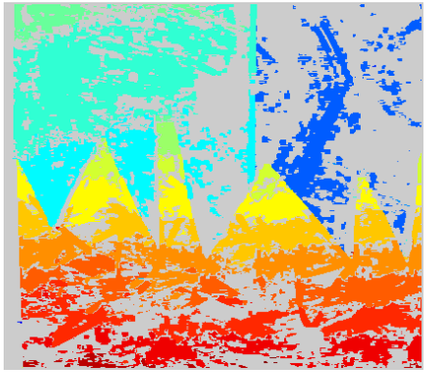
$$c(W_L, W_R) = \frac{2\,\mathrm{cov}(W_L, W_R)}{\mathrm{var}\, W_L + \mathrm{var}\, W_R} \in [-1, 1]$$

$$\Delta(W_L, W_R) = \alpha\,\frac{4\,|c(W_L, W_R)|}{\mathrm{var}\, W_L + \mathrm{var}\, W_R} + \beta, \quad \alpha, \beta \geq 0$$

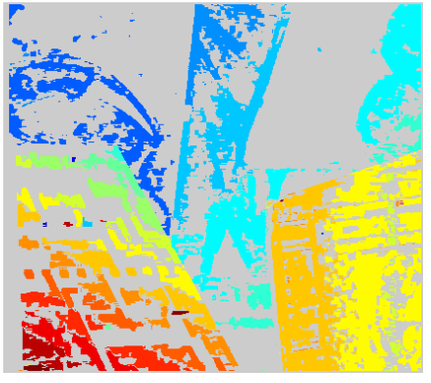
Middlebury Dataset results



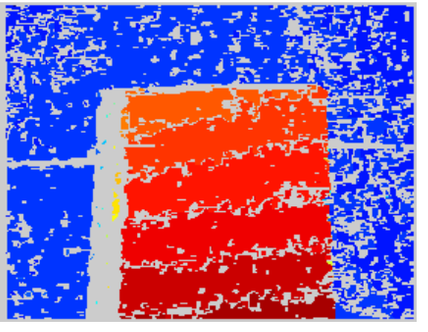
tsukuba



sawtooth



venus



map

	stable matching				**the best reported results**		
dataset	map density	error statistics			error statistics		
		$B_{\bar{\mathcal{O}}}$	$B_{\bar{\mathcal{T}}}$	$B_{\mathcal{D}}$	$B_{\bar{\mathcal{O}}}$	$B_{\bar{\mathcal{T}}}$	$B_{\mathcal{D}}$
tsukuba	43%	1.4%	**0.22%**	7.8%	1.5%	**0.42%**	6.3%
sawtooth	52%	1.6%	**0.03%**	14%	0.3%	**0.00%**	3.4%
venus	40%	0.8%	**0.04%**	10%	0.5%	**0.31%**	2.5%
map	74%	0.3%	**0.20%**	3.6%	0.2%	—	2.4%

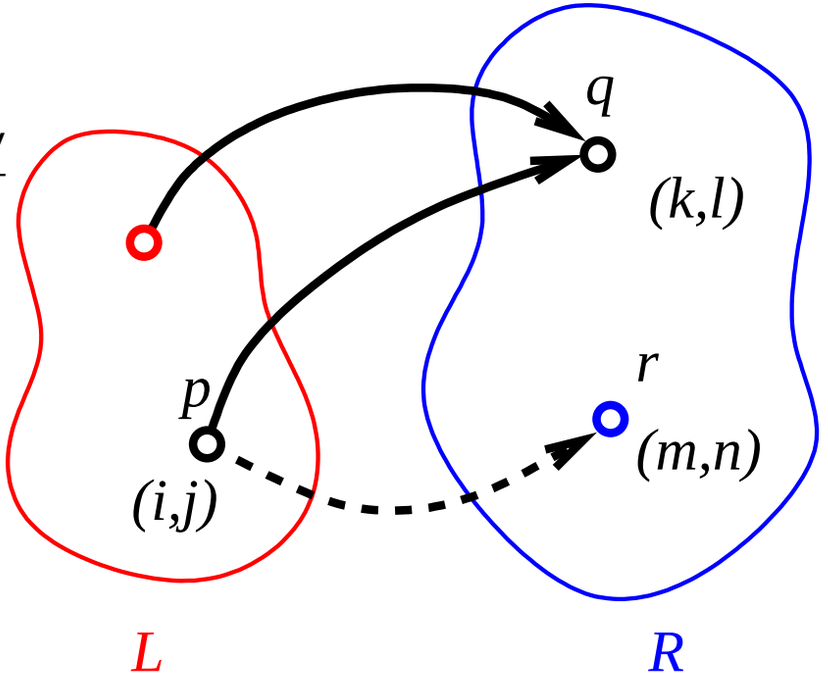
$B_{\bar{\mathcal{O}}}$ mismatches in non-occluded region

$B_{\bar{\mathcal{T}}}$ mismatches in textureless regions

$B_{\mathcal{D}}$ errors at disparity discontinuities

Generalization to sparse matching / tracking

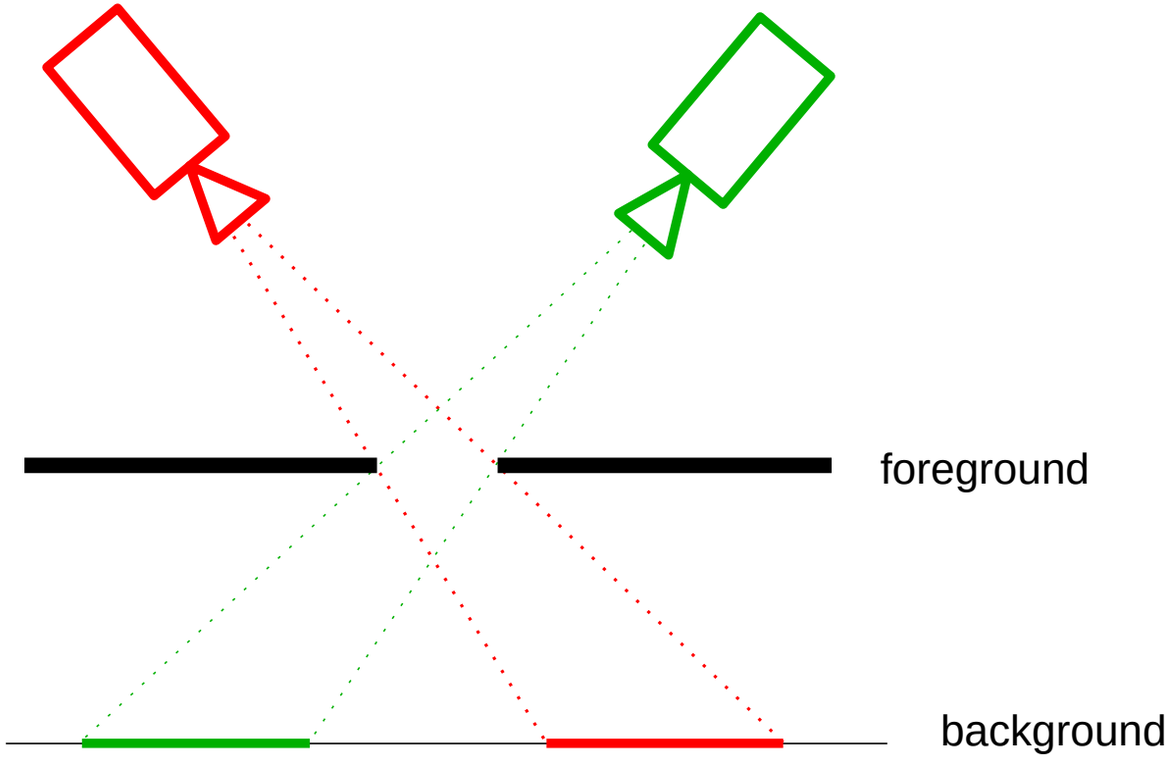
- sparse / dense / points / point sets / regions
- X-zone can be always constructed
- more dense zone improves error rate exponentially



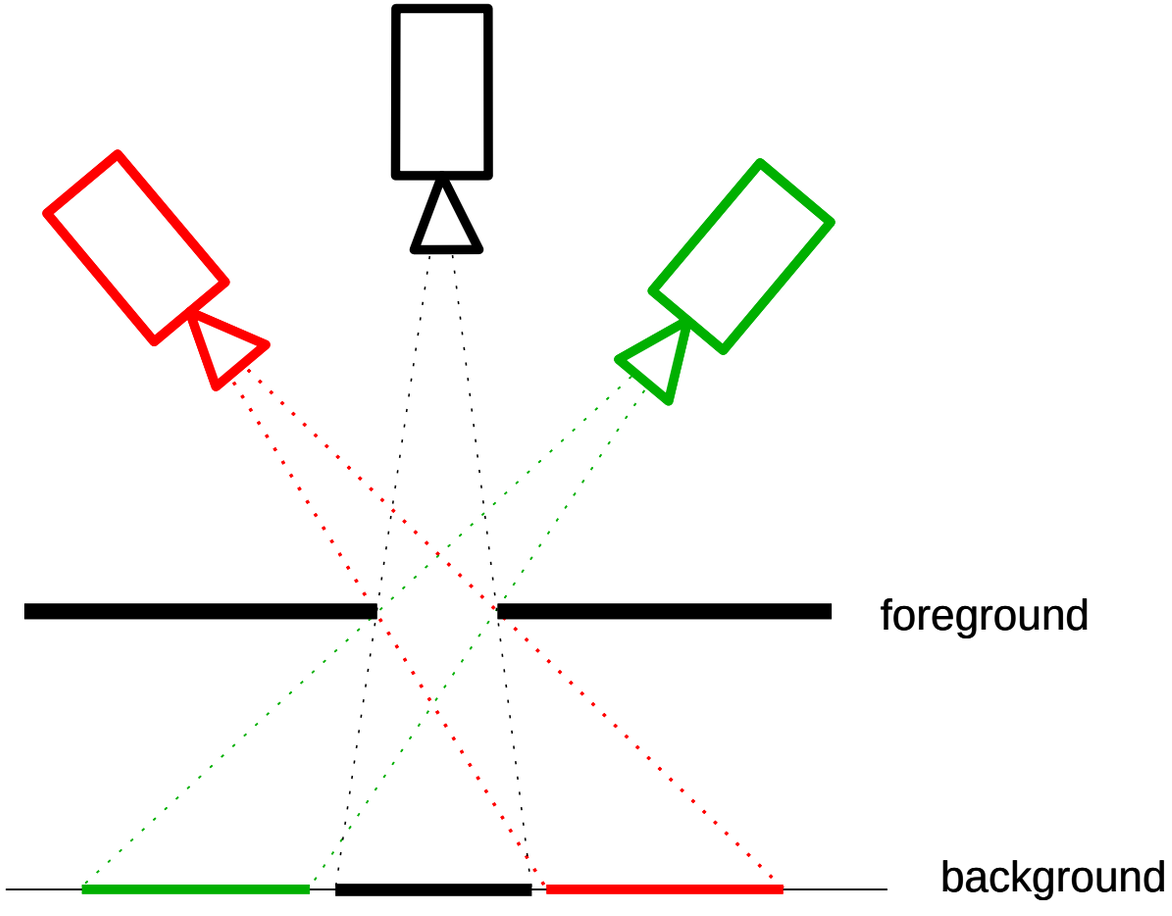
Necessary ingredients

1. match pre-selection (optional; improves speed)
2. **inhibition zone** for each tentative match
3. discriminable **signature compatibility** function
4. confidence interval for signature compatibility (optional; improves error rate)

Binocular peeking through a narrow slit is difficult

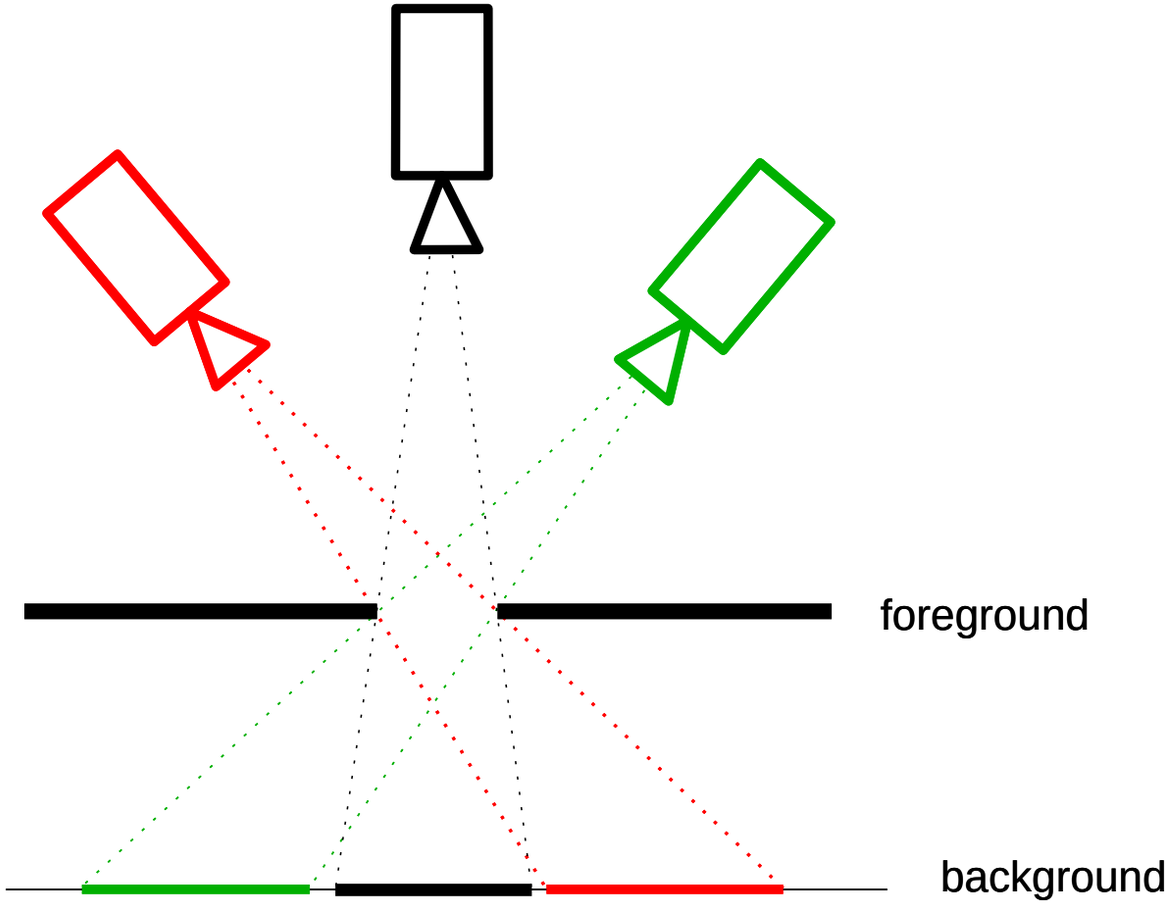


Binocular peeking through a narrow slit is difficult



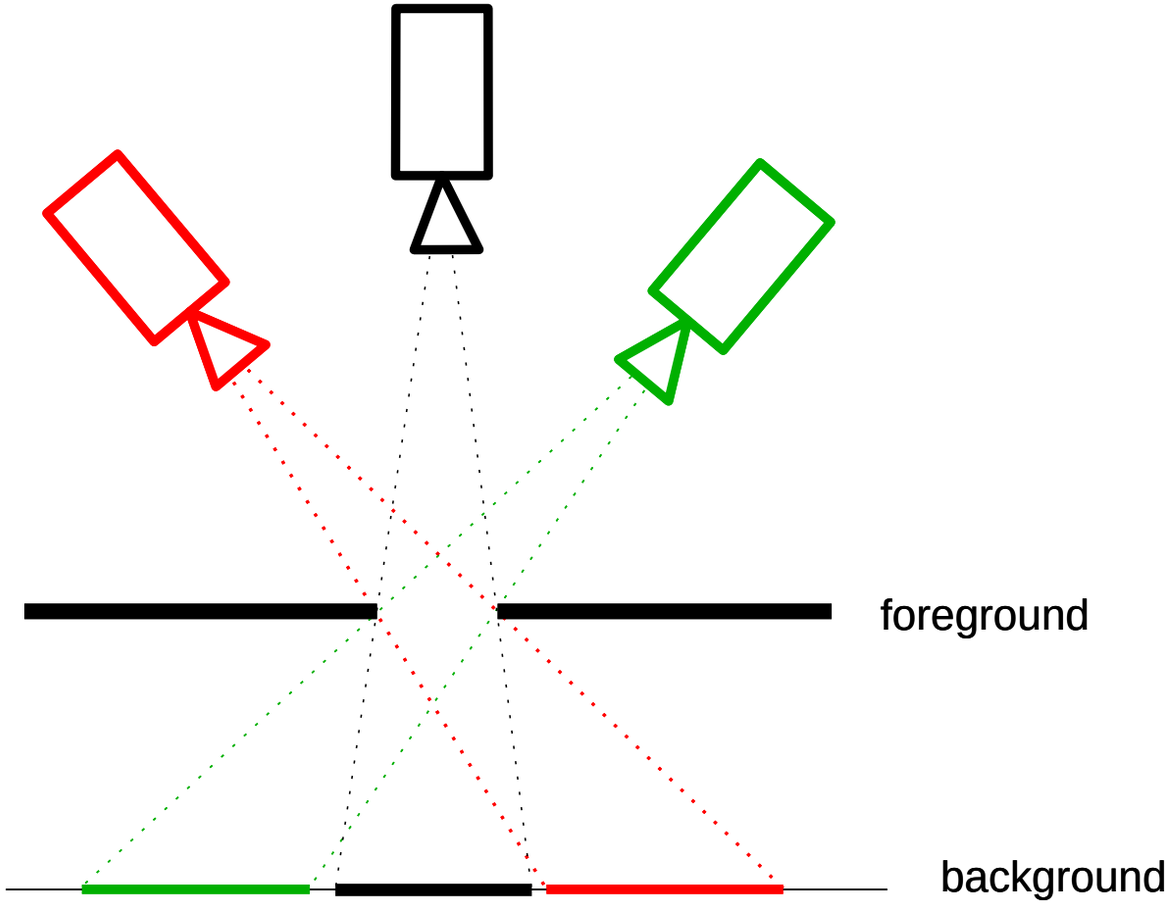
- Adding cameras may not help!

Binocular peeking through a narrow slit is difficult



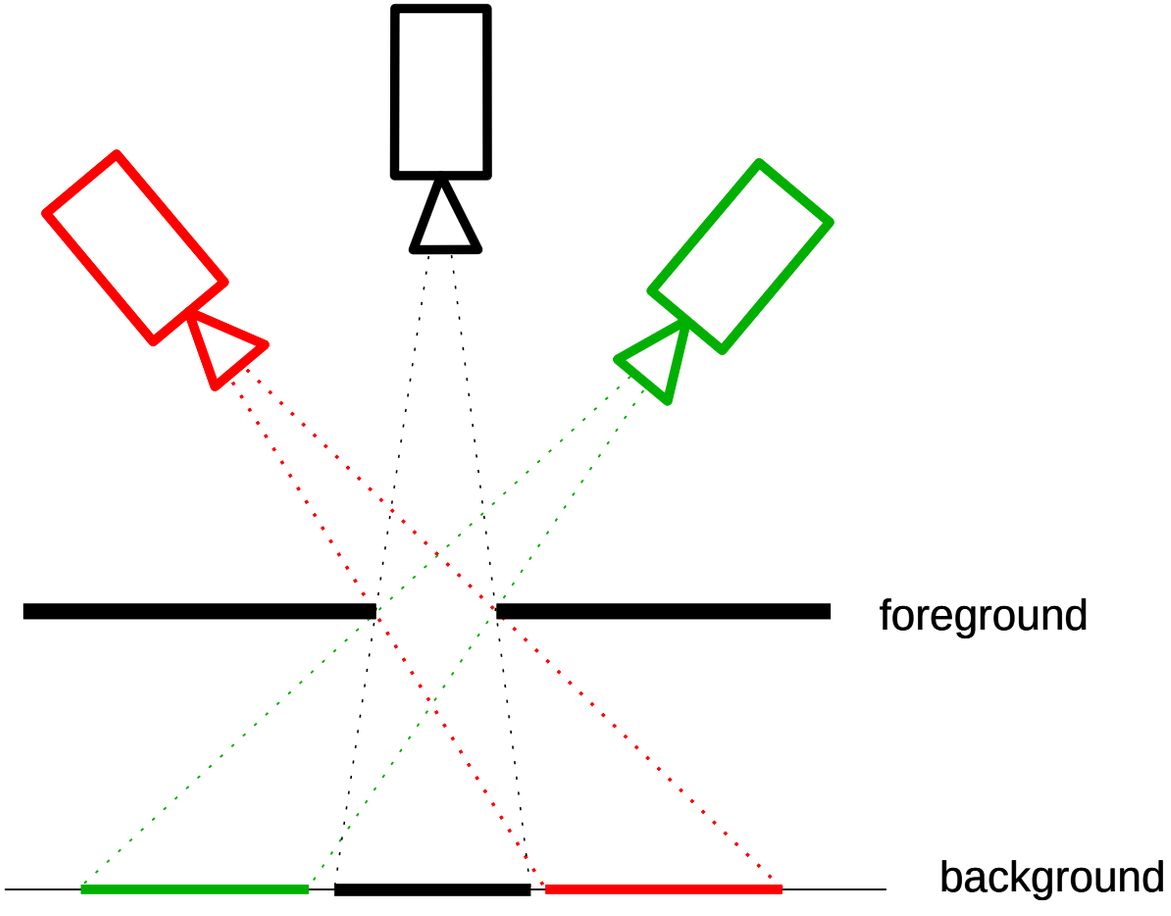
- Adding cameras may not help!
- Continuity model fails.

Binocular peeking through a narrow slit is difficult



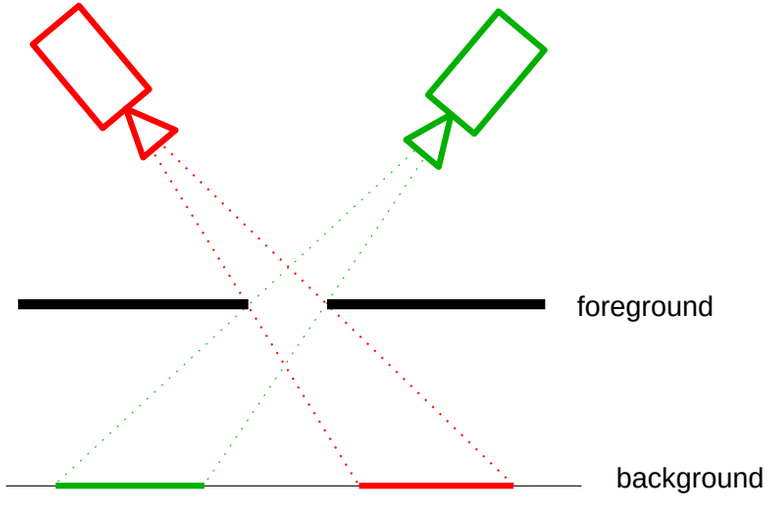
- Adding cameras may not help!
- Continuity model fails.
- Self-occlusion model fails.

Binocular peeking through a narrow slit is difficult

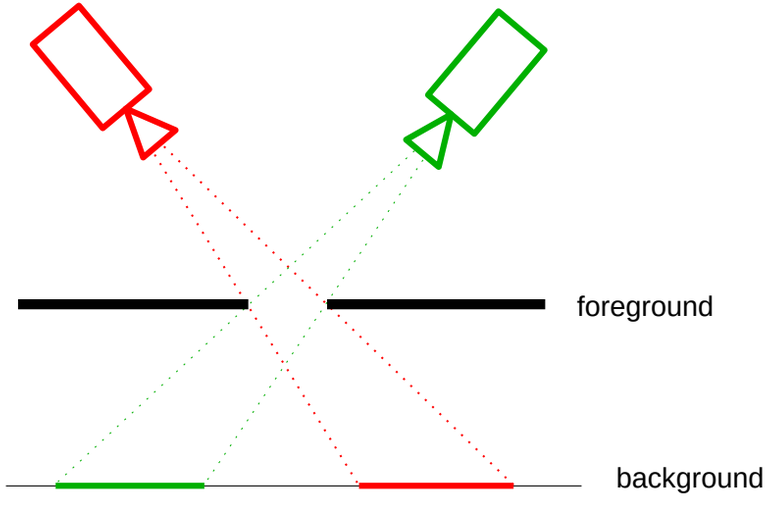


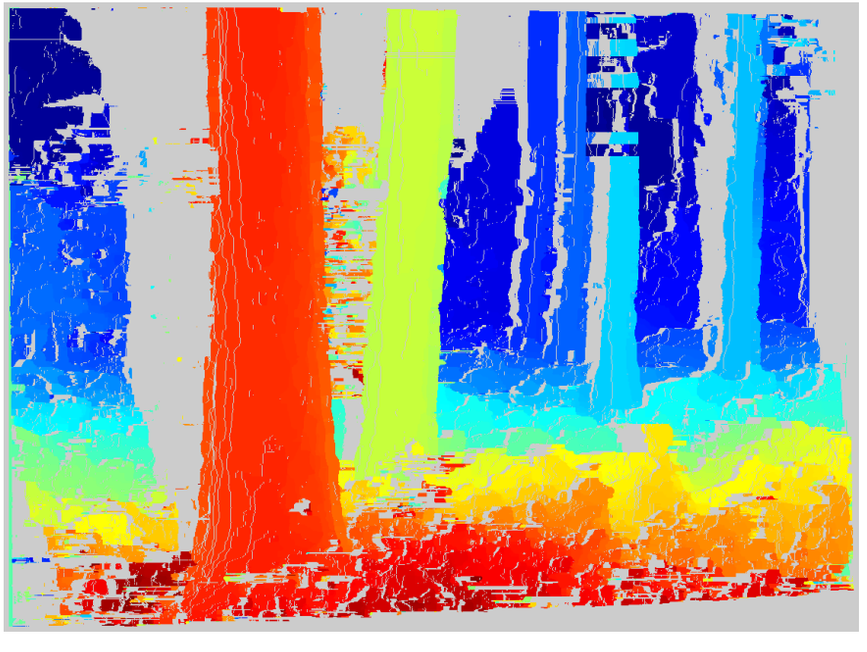
- Adding cameras may not help!
- Continuity model fails.
- Self-occlusion model fails.
- Detecting matches at a confidence level **may** save it. (But no repetitive texture is allowed)

Results: Cedar Grove



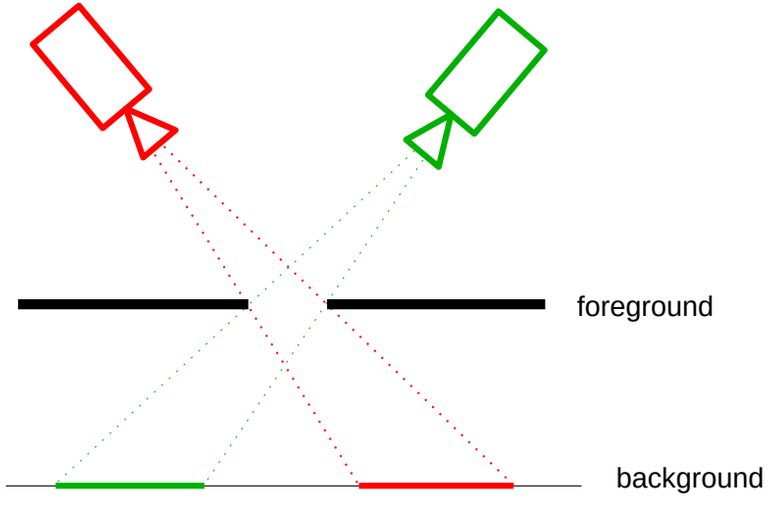
Results: Cedar Grove

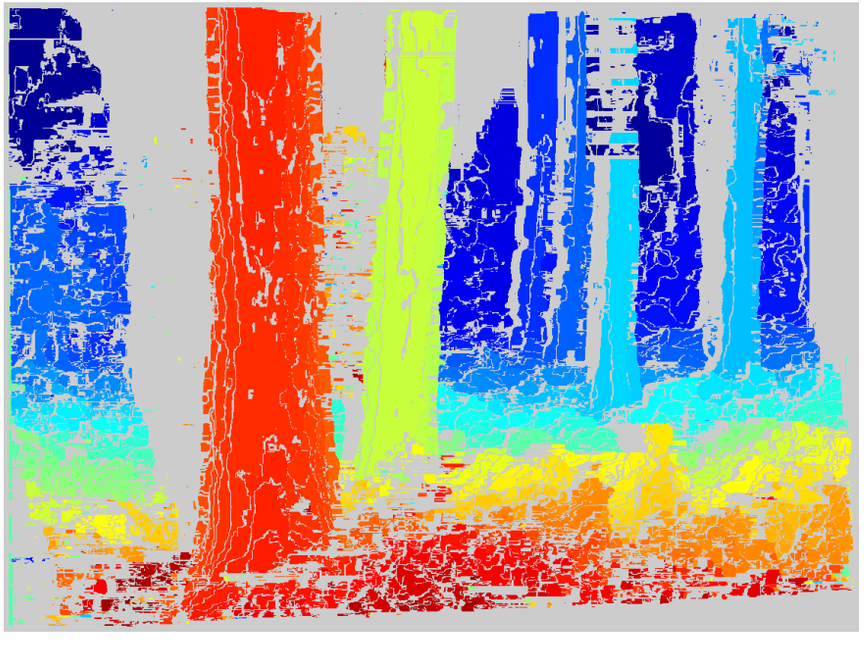




confidence interval width 0% [of NCC range]

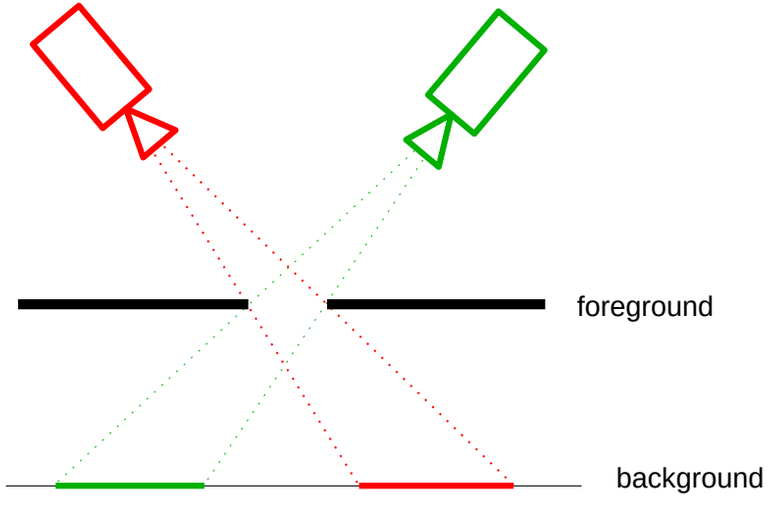
Results: Cedar Grove

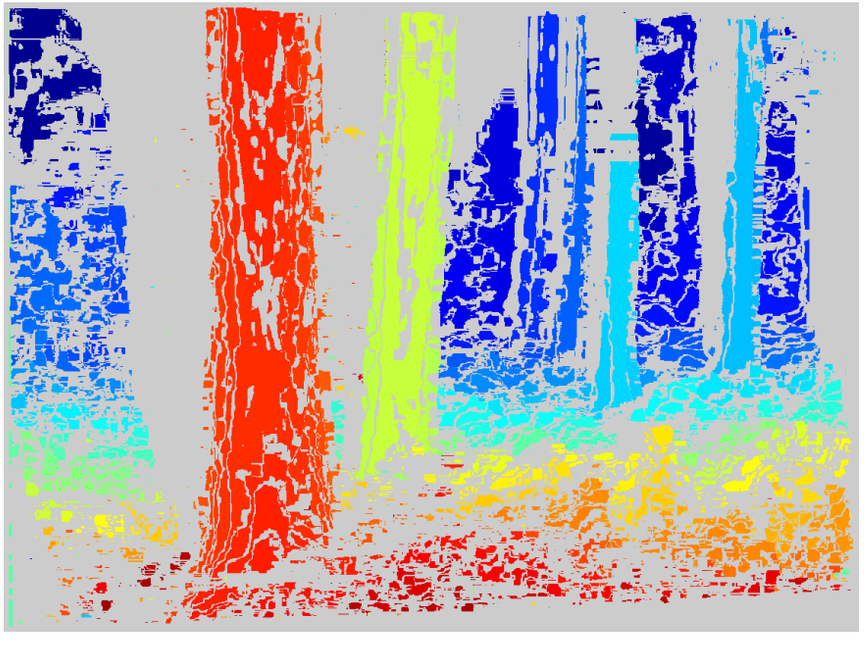




confidence interval width 0.5% [of NCC range]

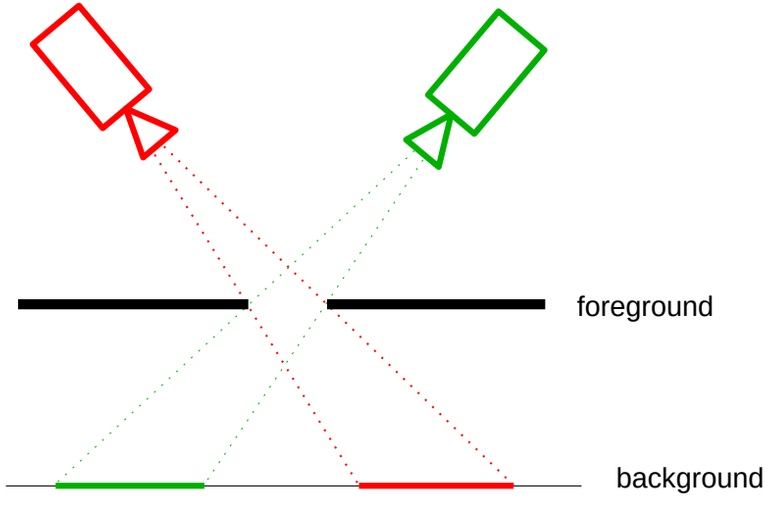
Results: Cedar Grove

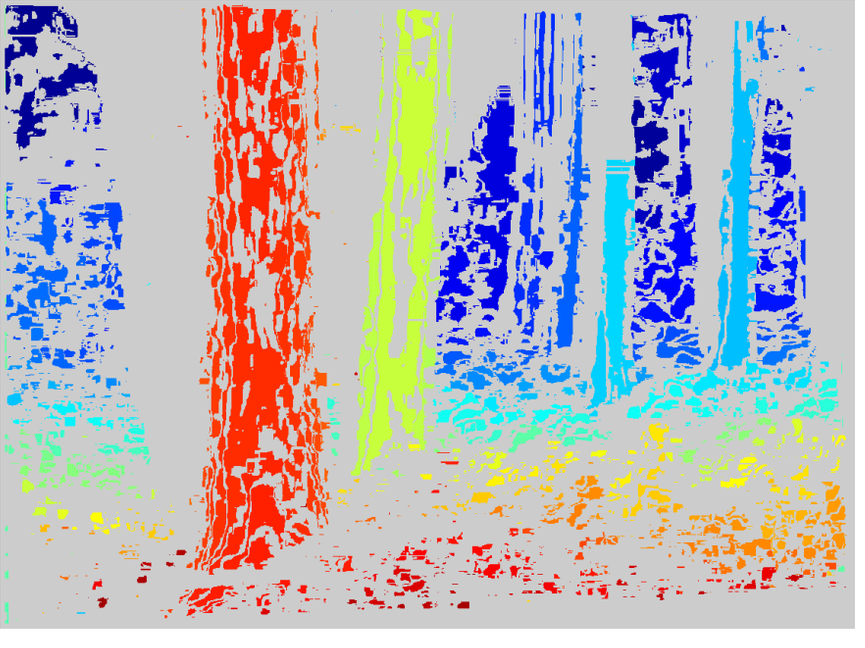




confidence interval width 1.5% [of NCC range]

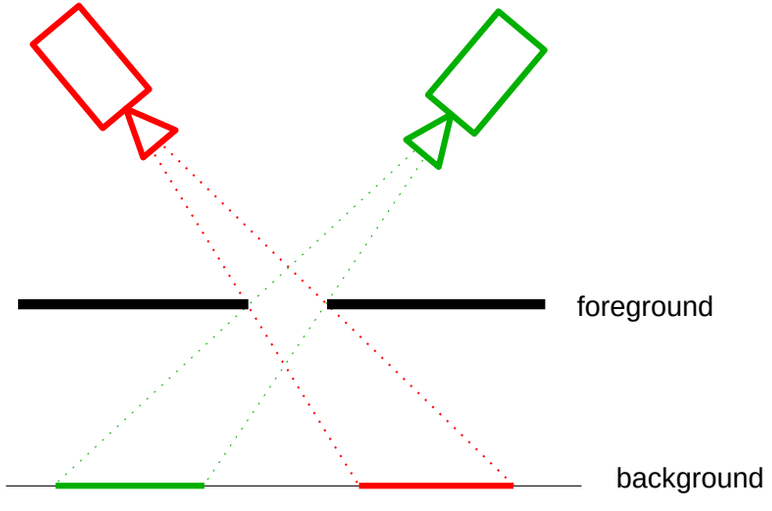
Results: Cedar Grove

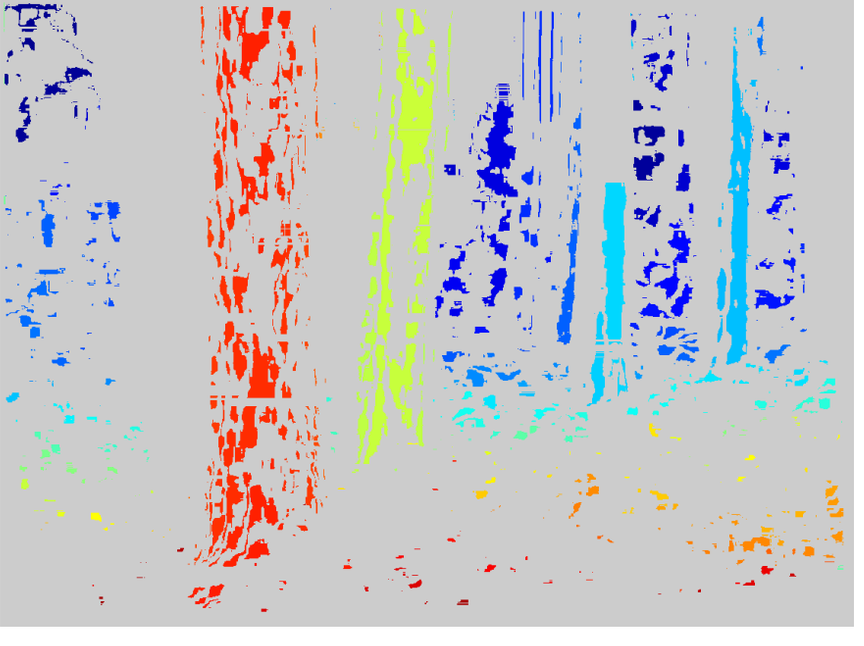




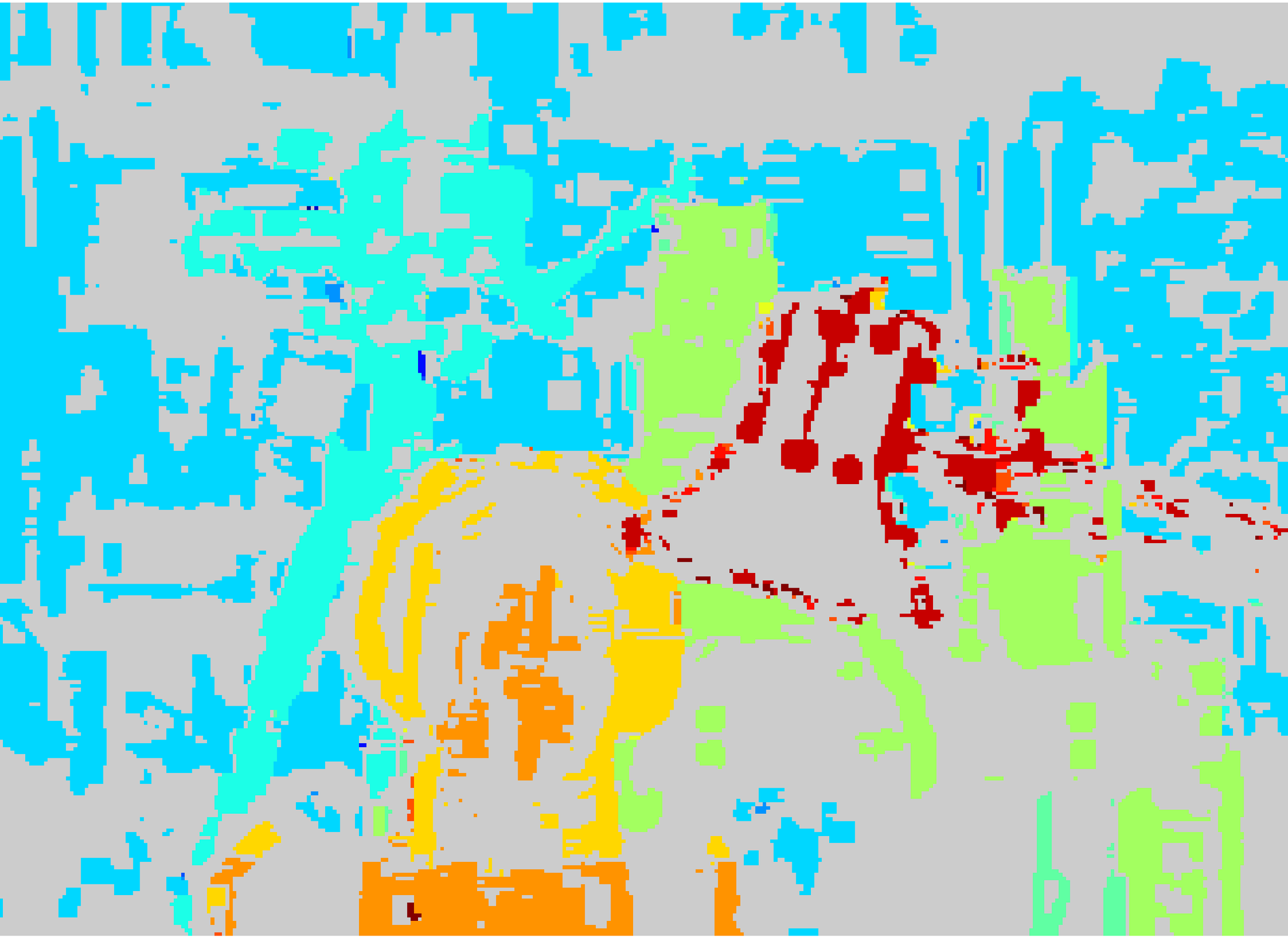
confidence interval width 2.5% [of NCC range]

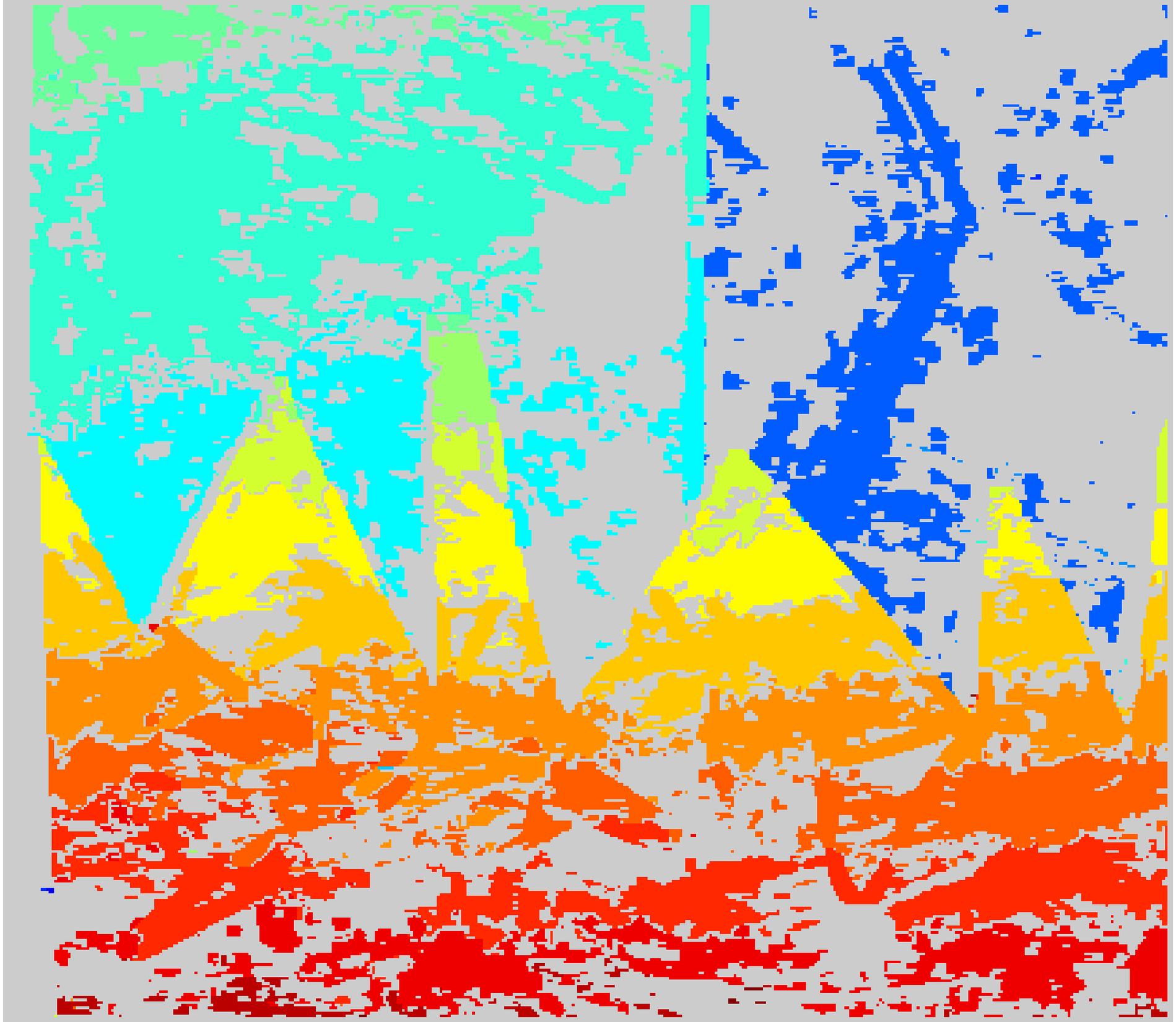
Results: Cedar Grove

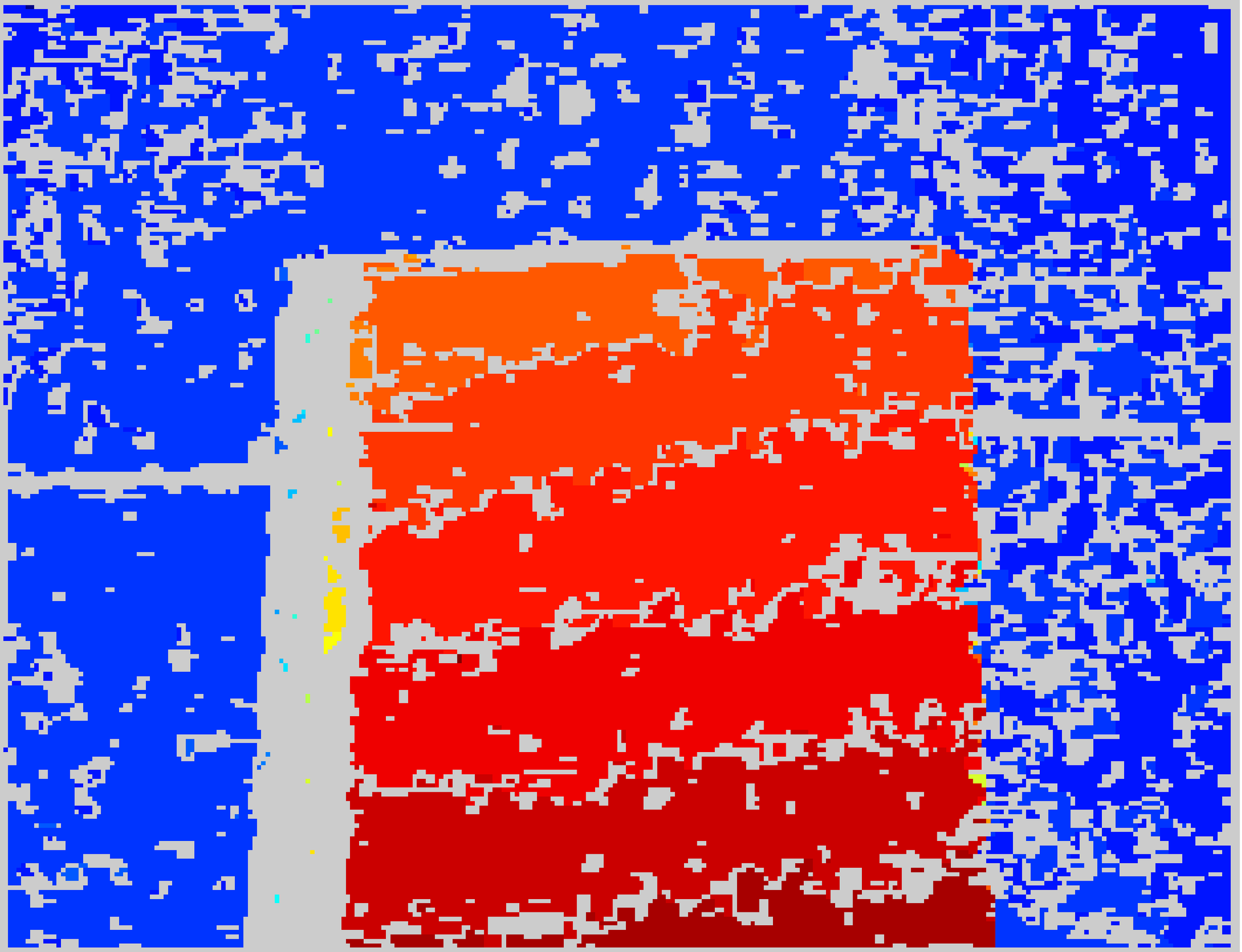


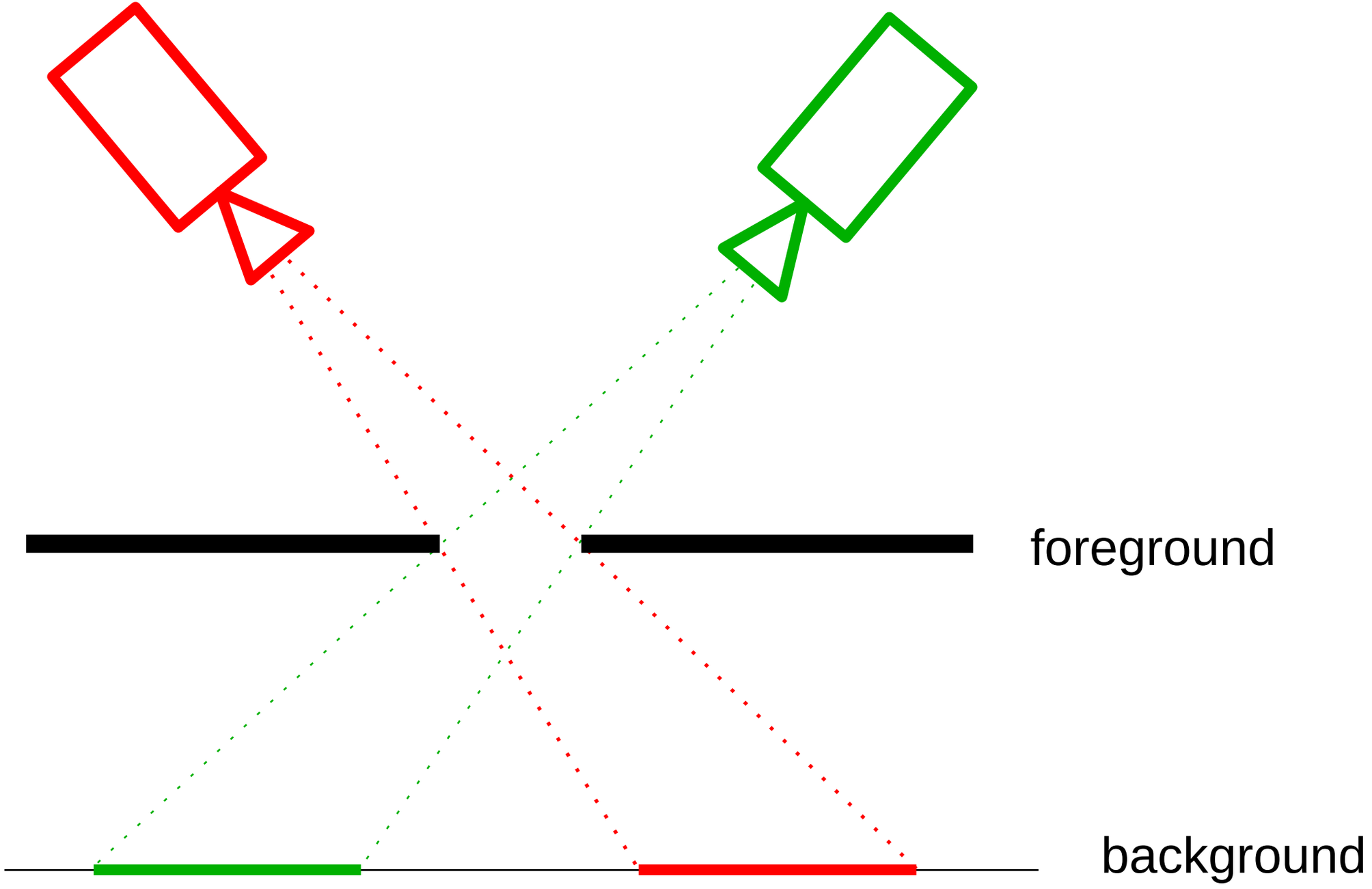


confidence interval width 5% [of NCC range]





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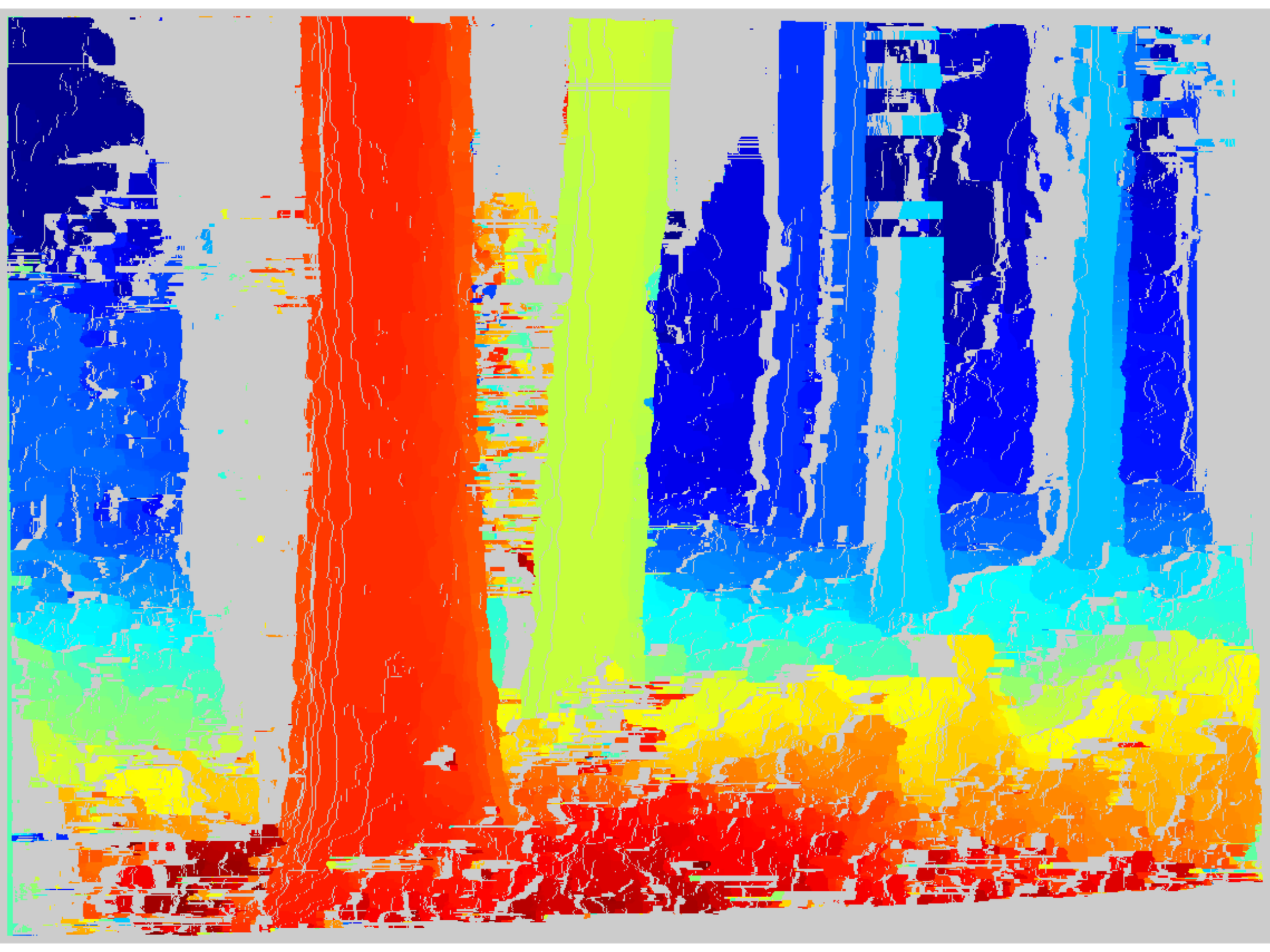

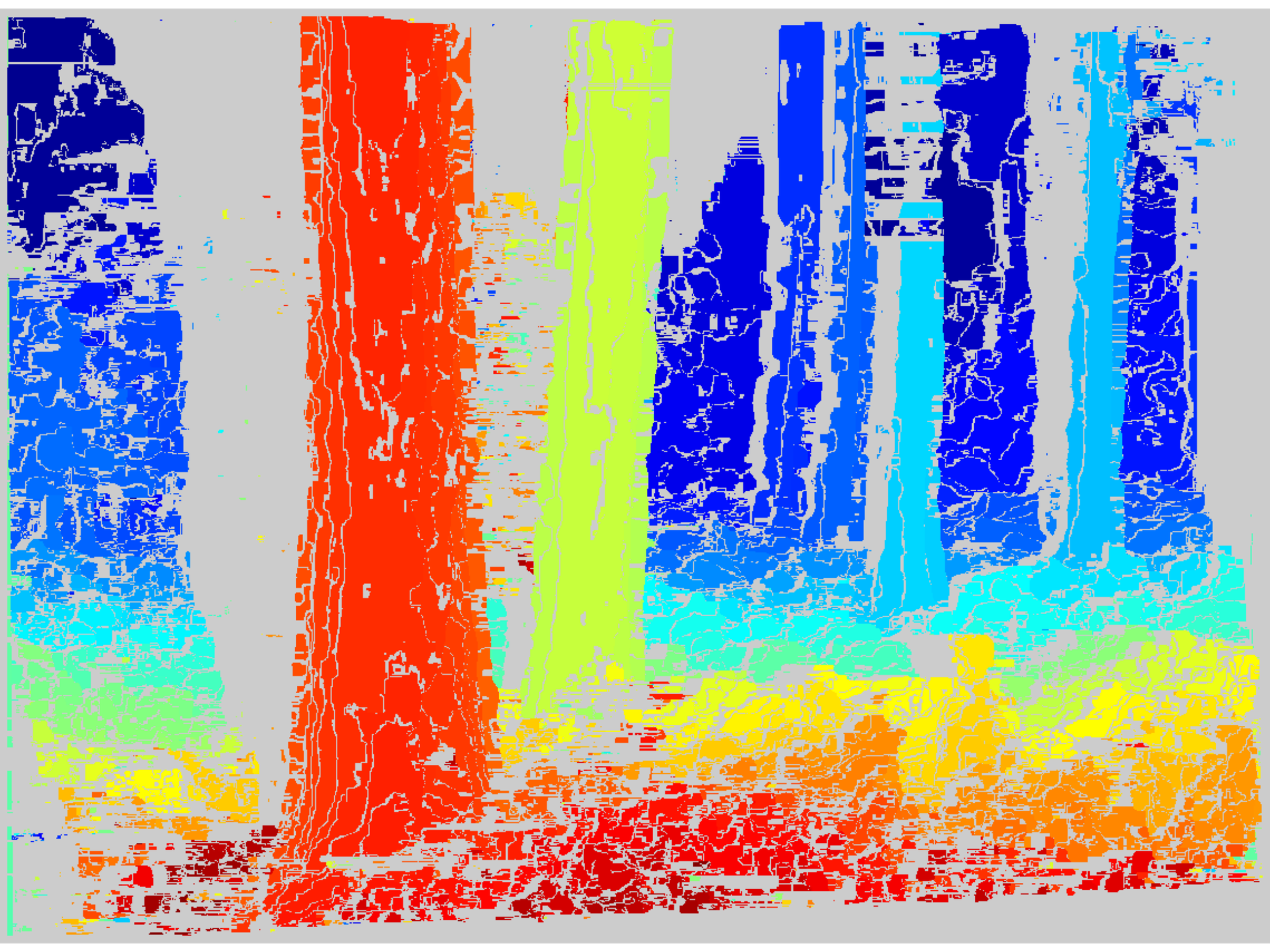

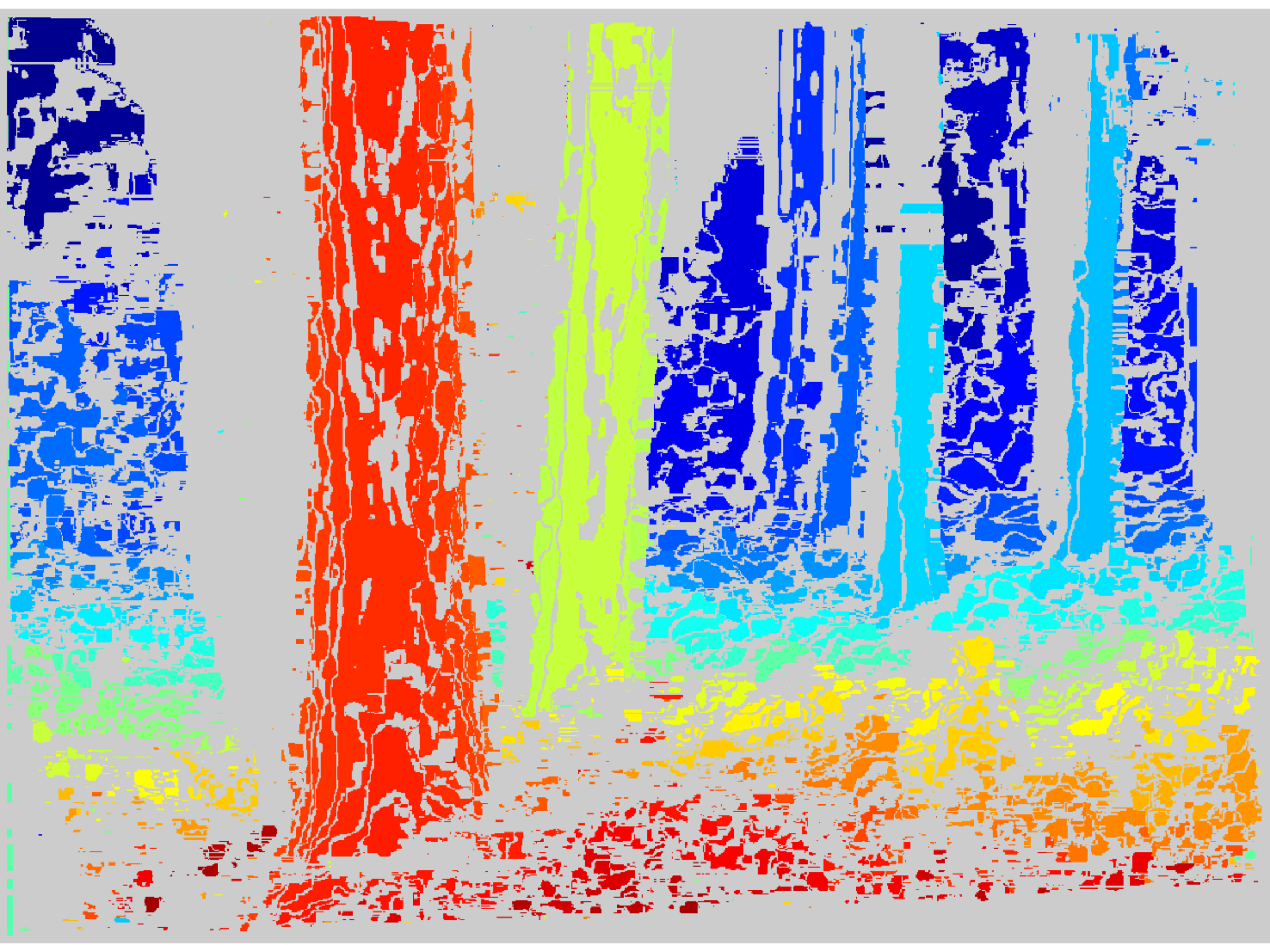

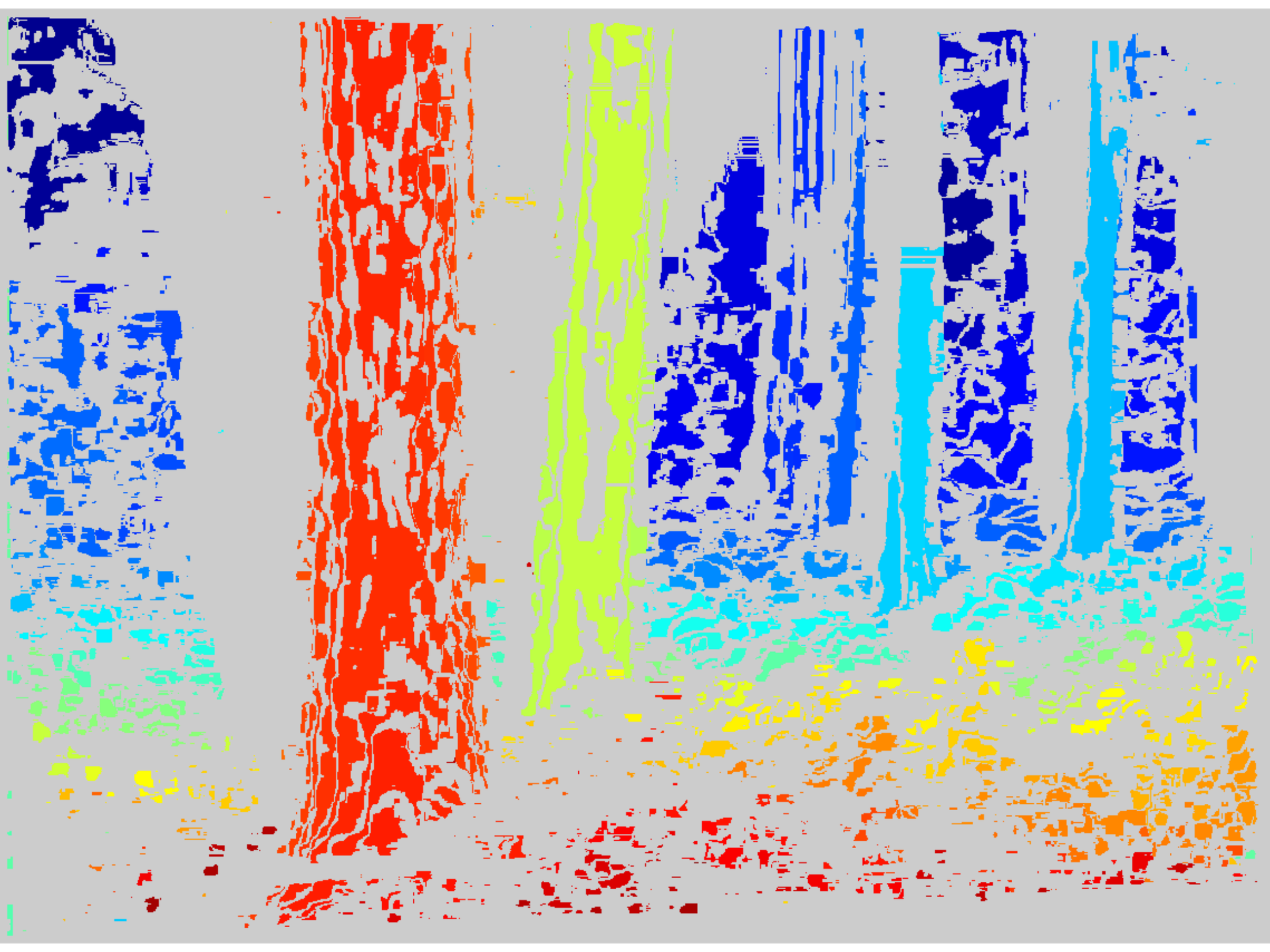

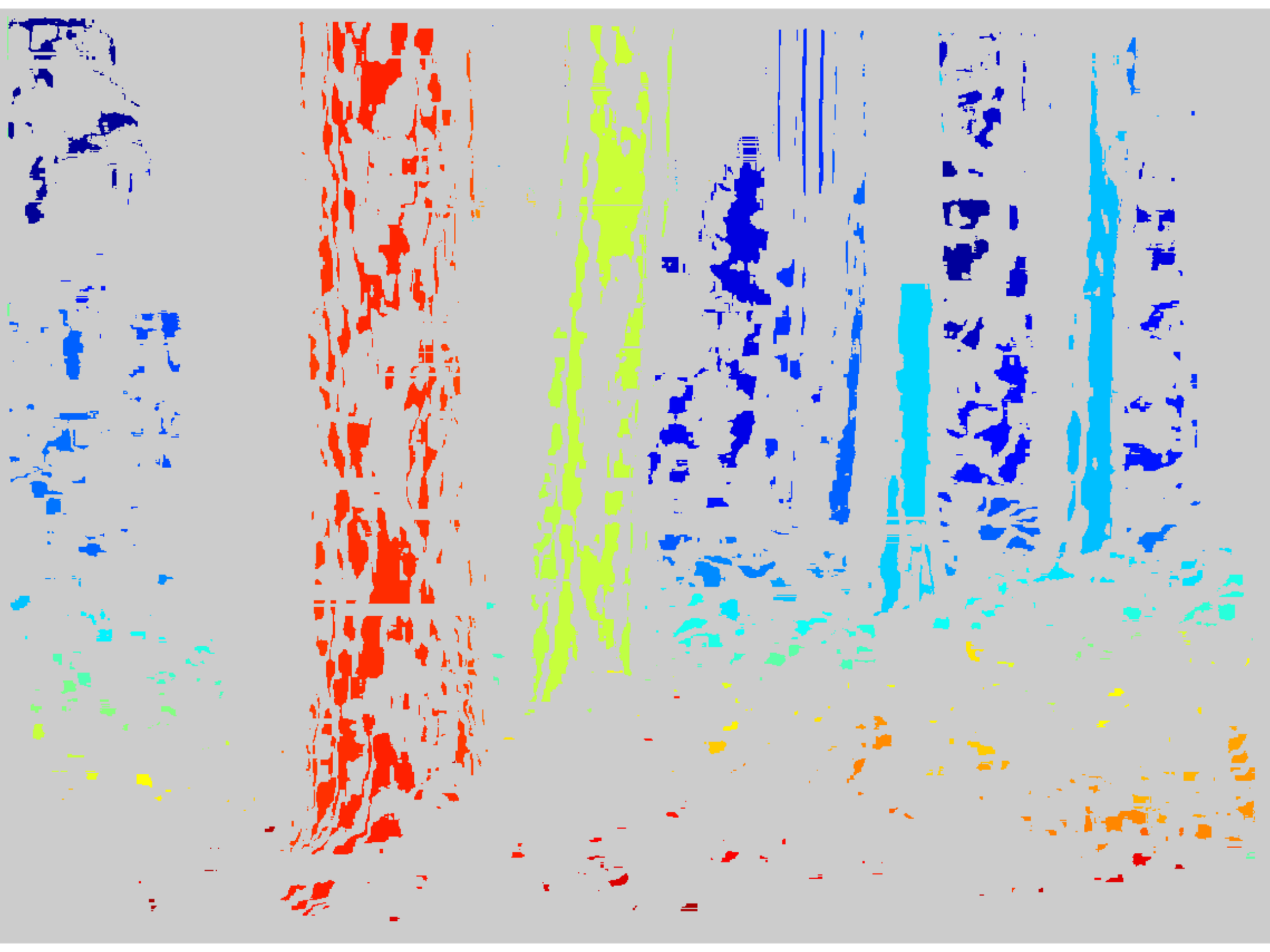

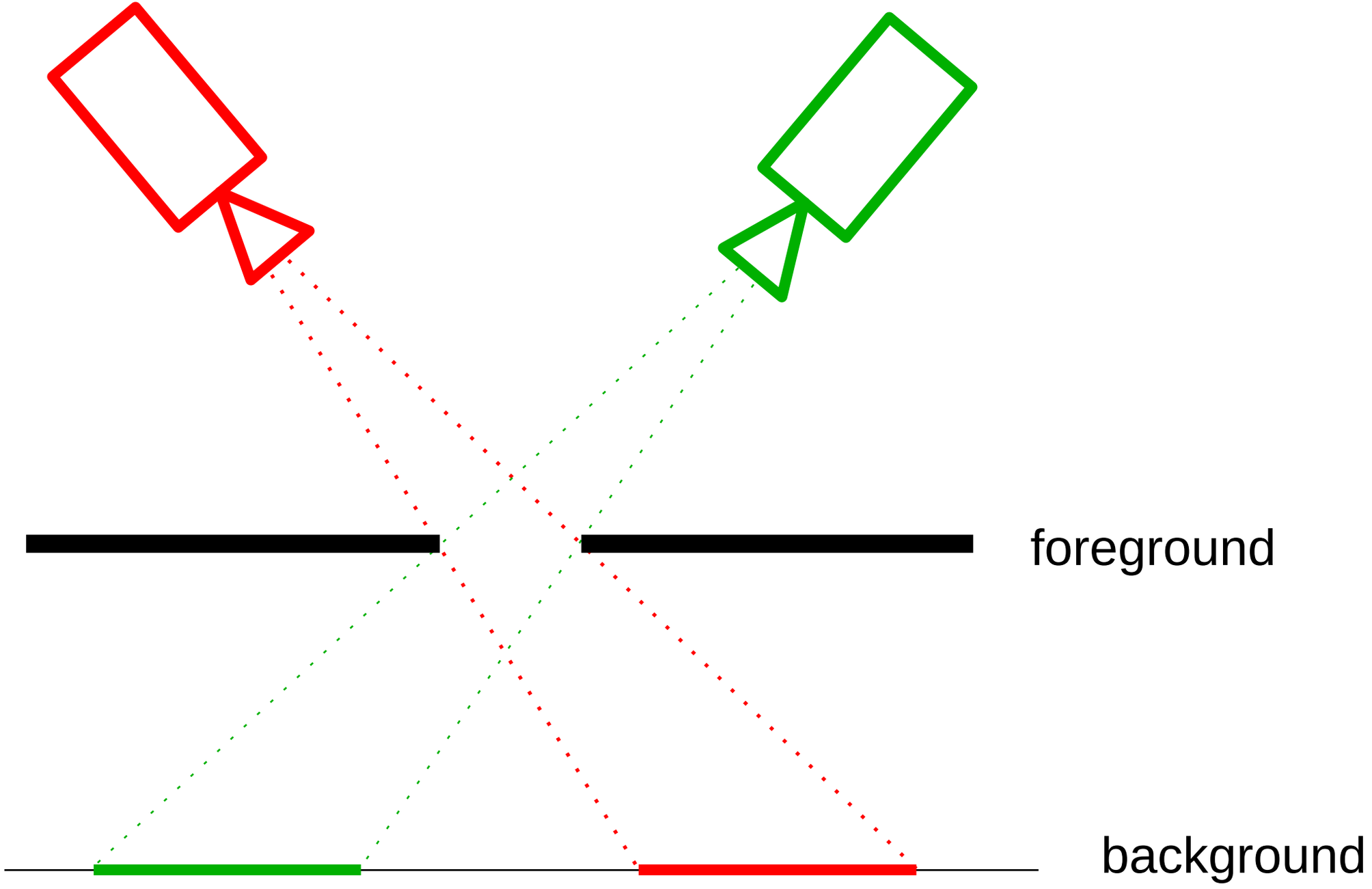
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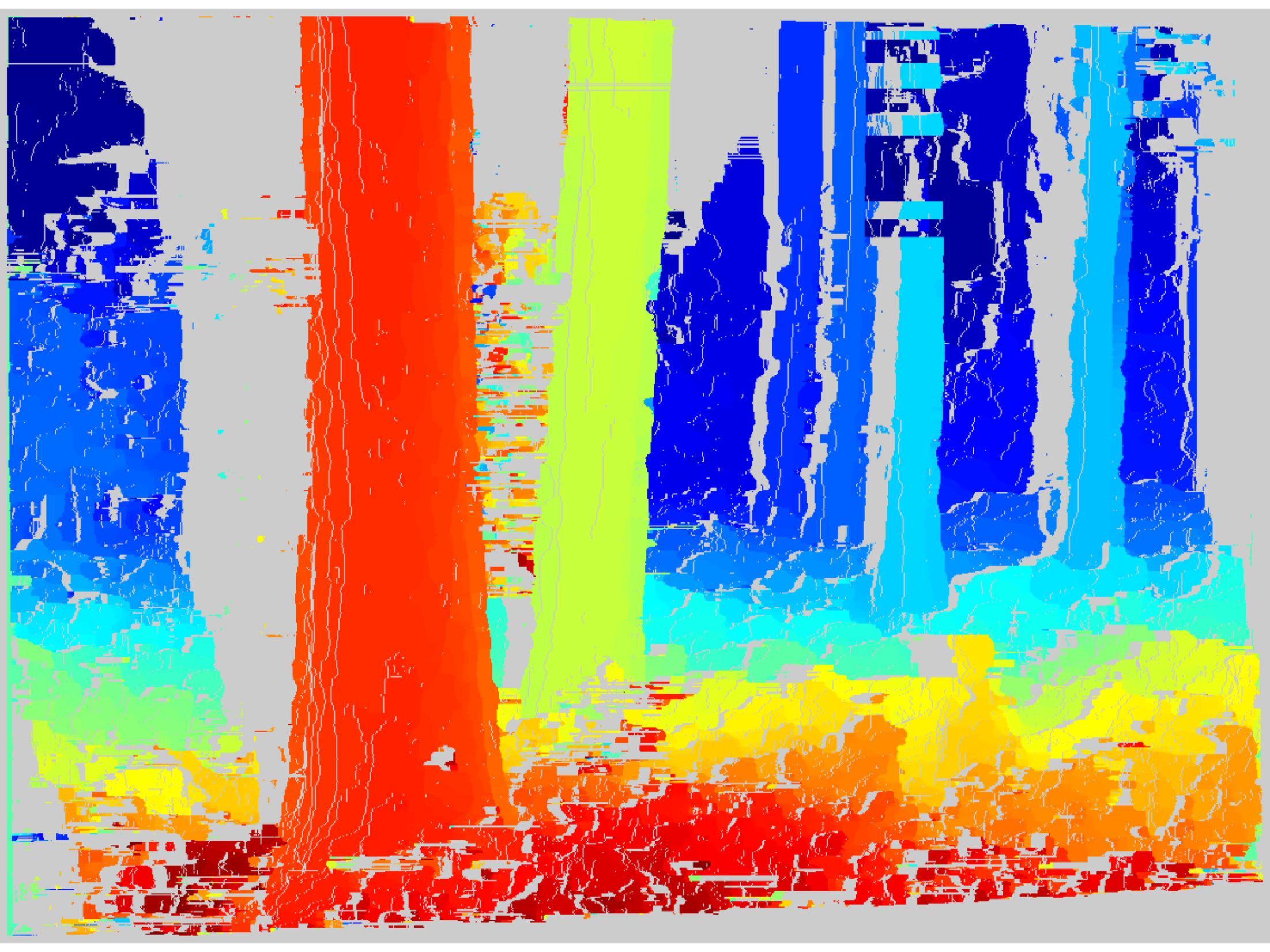

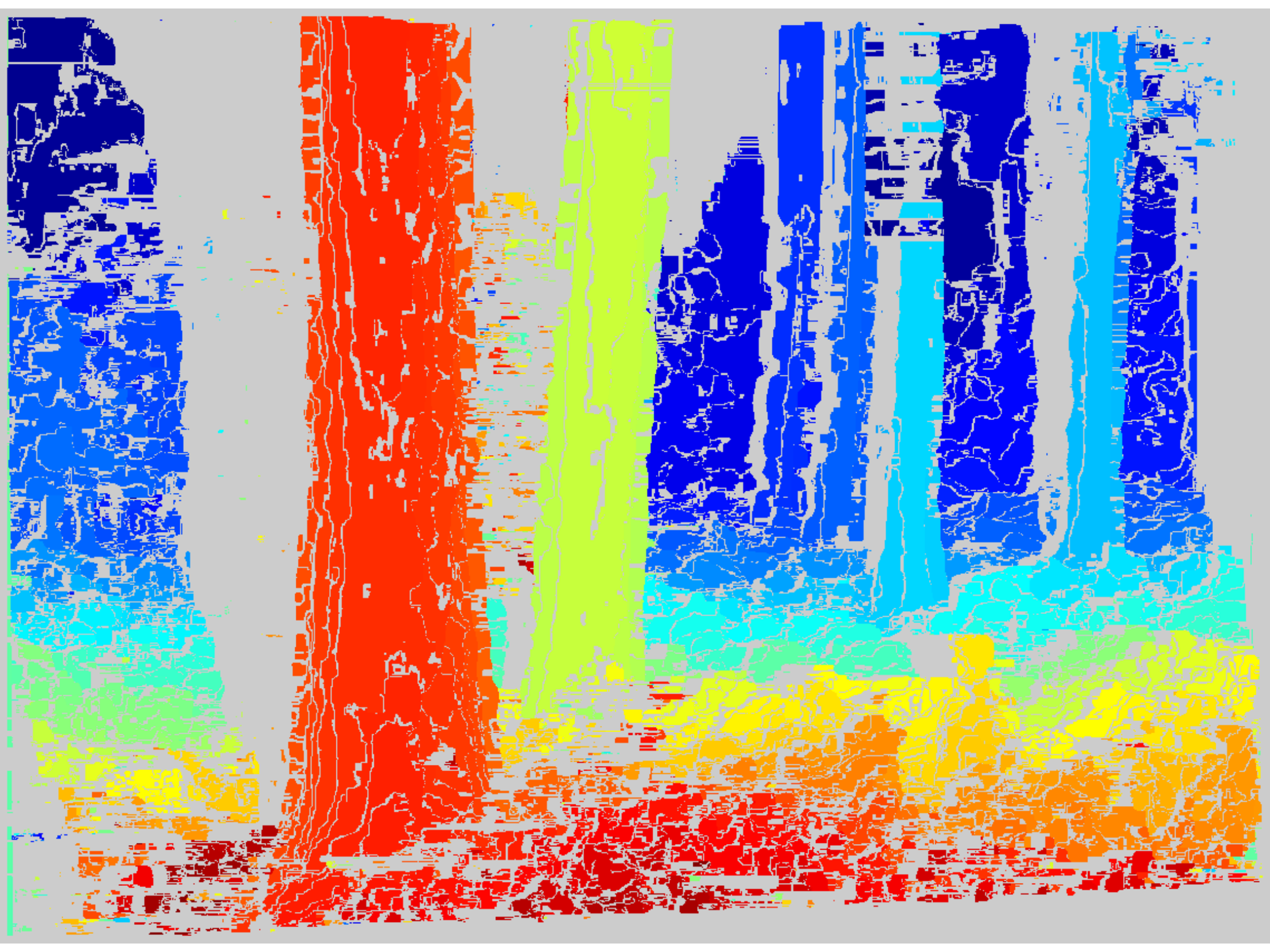

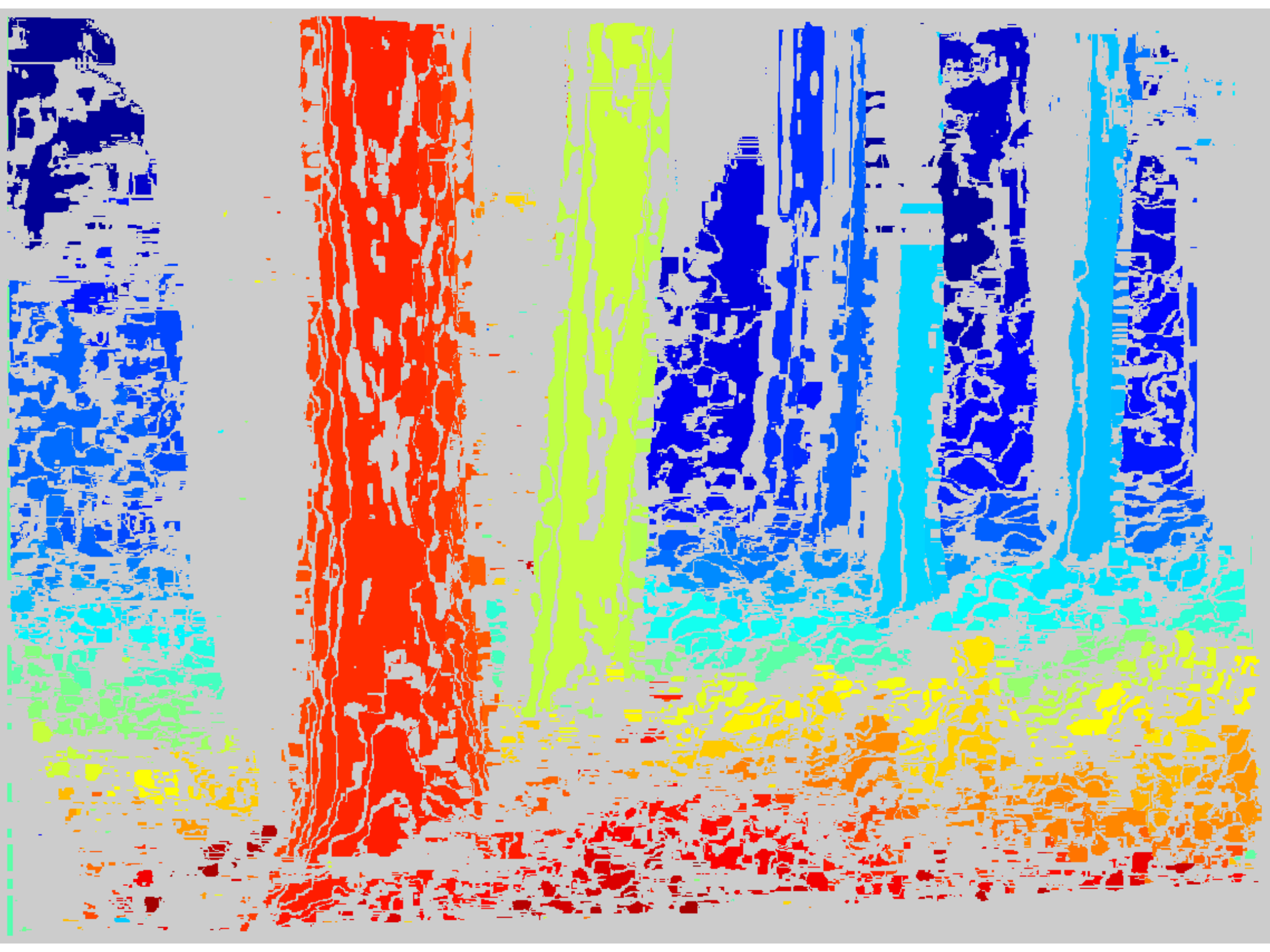

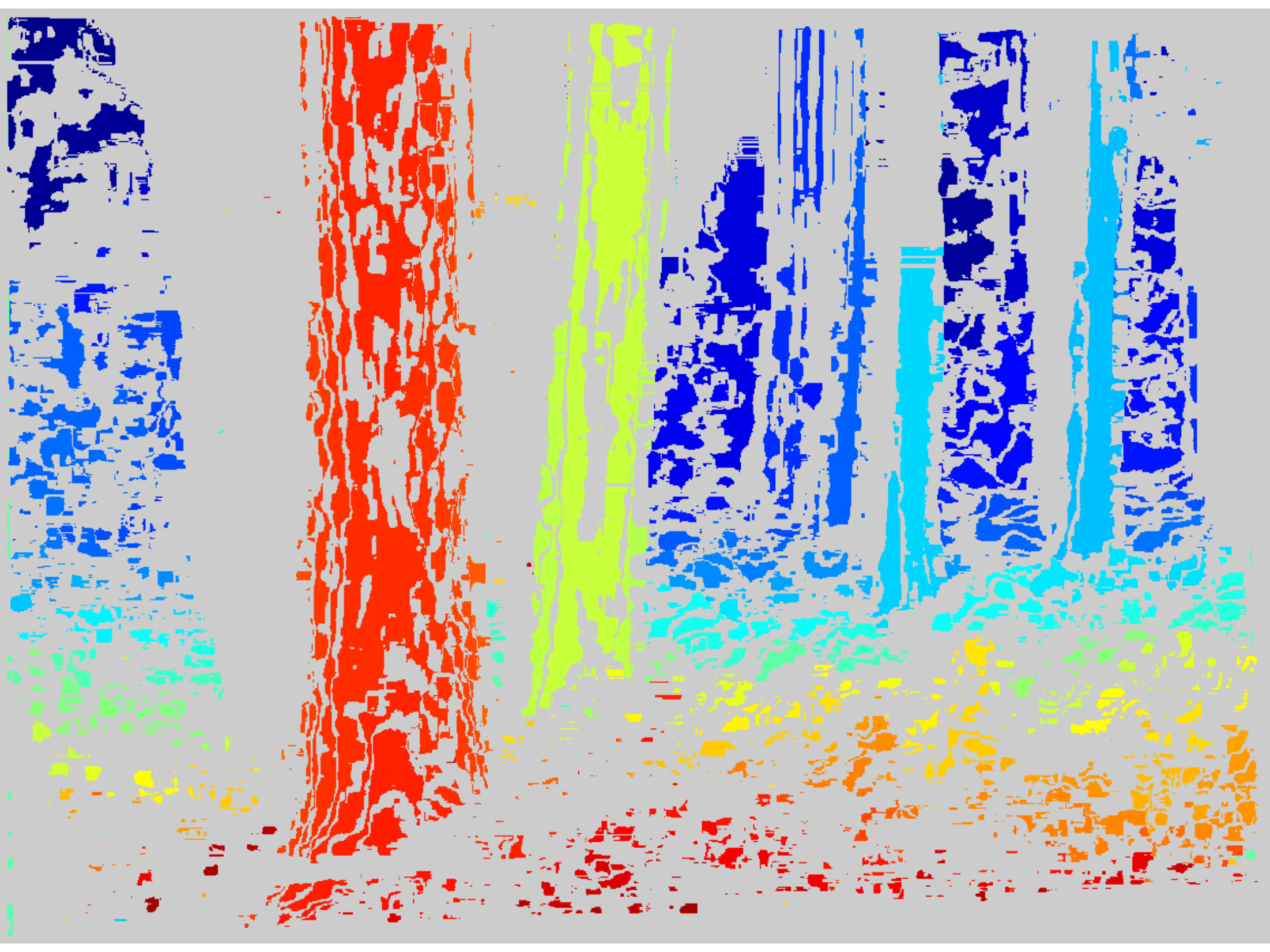

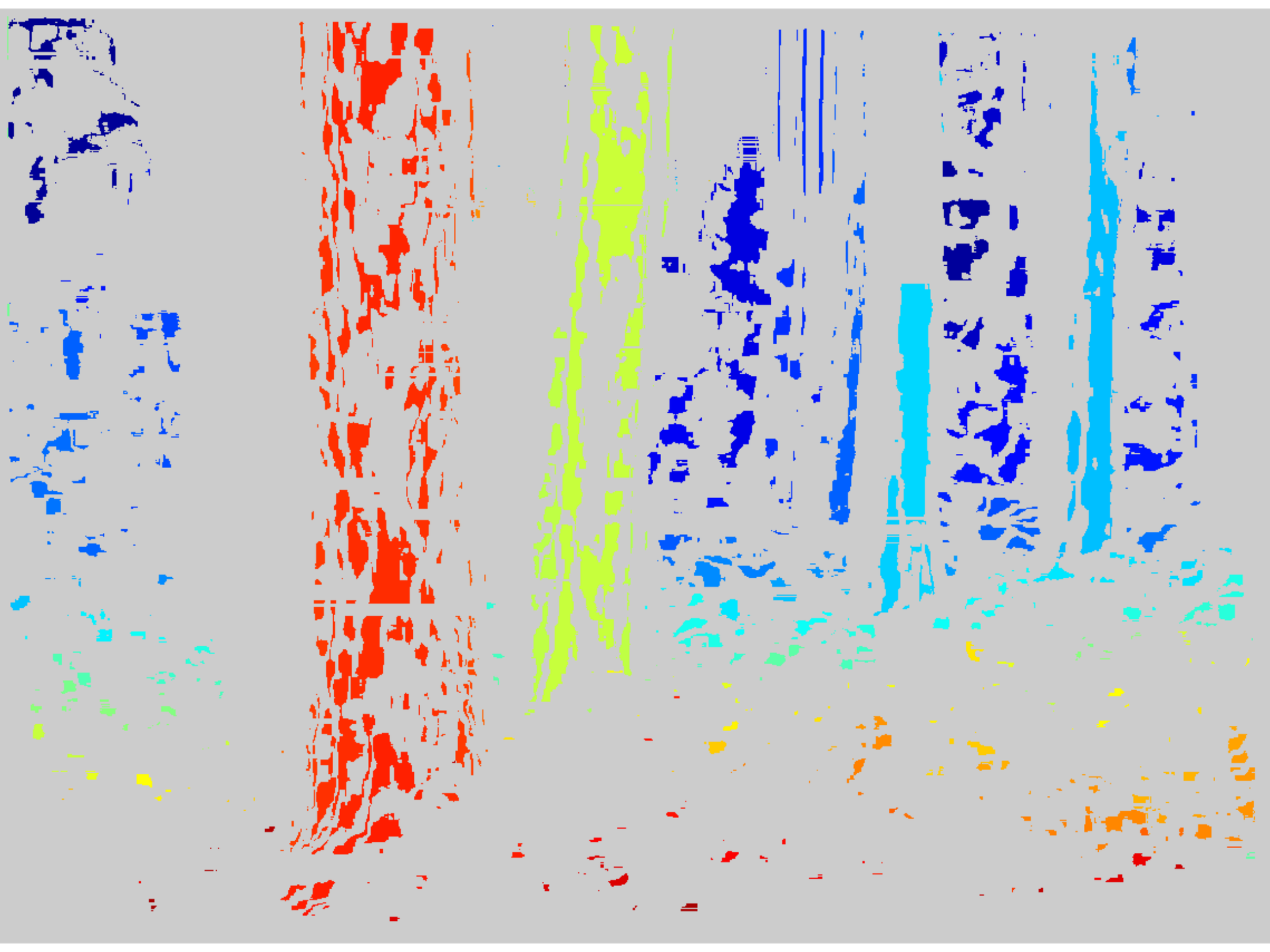

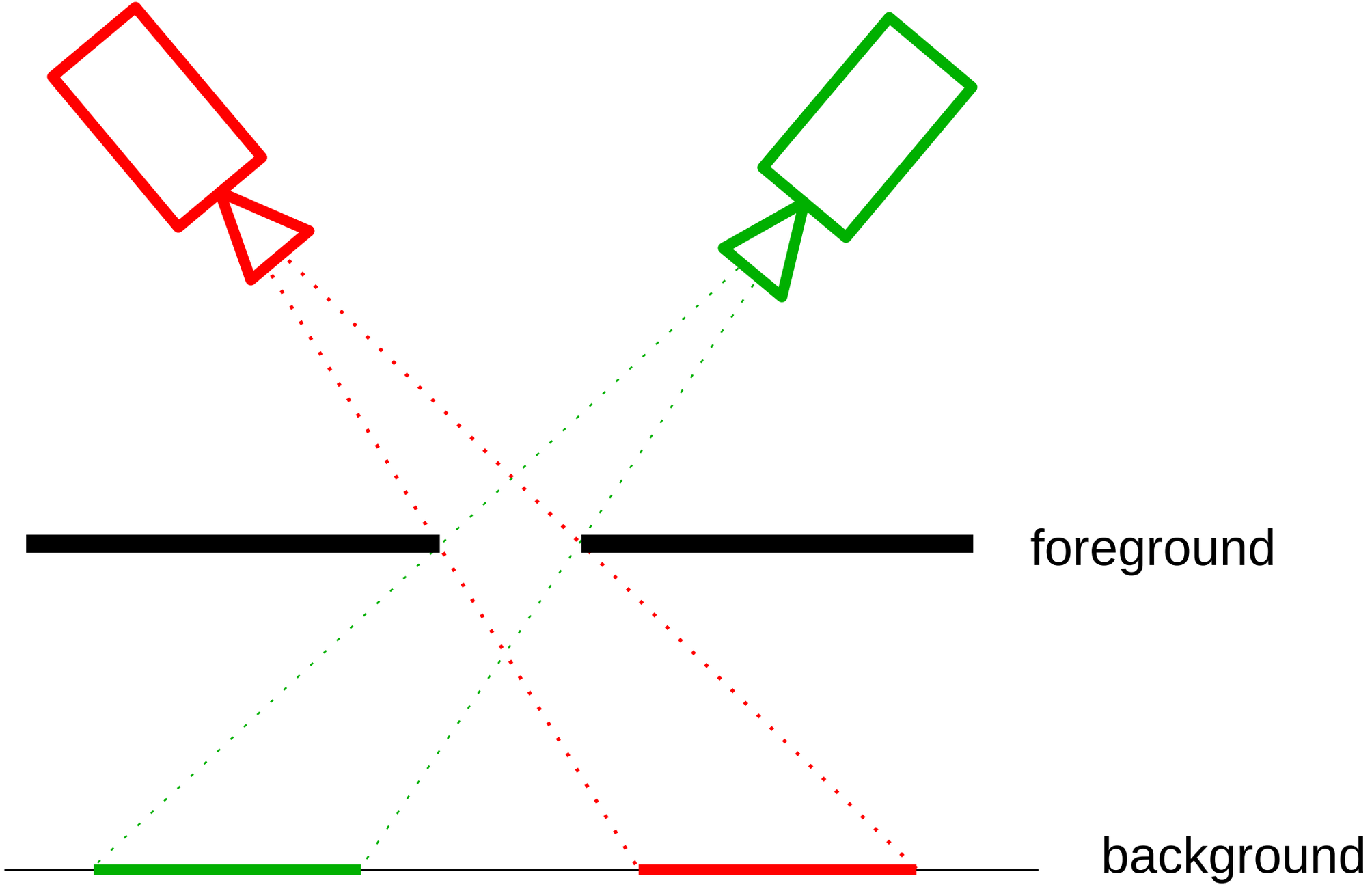
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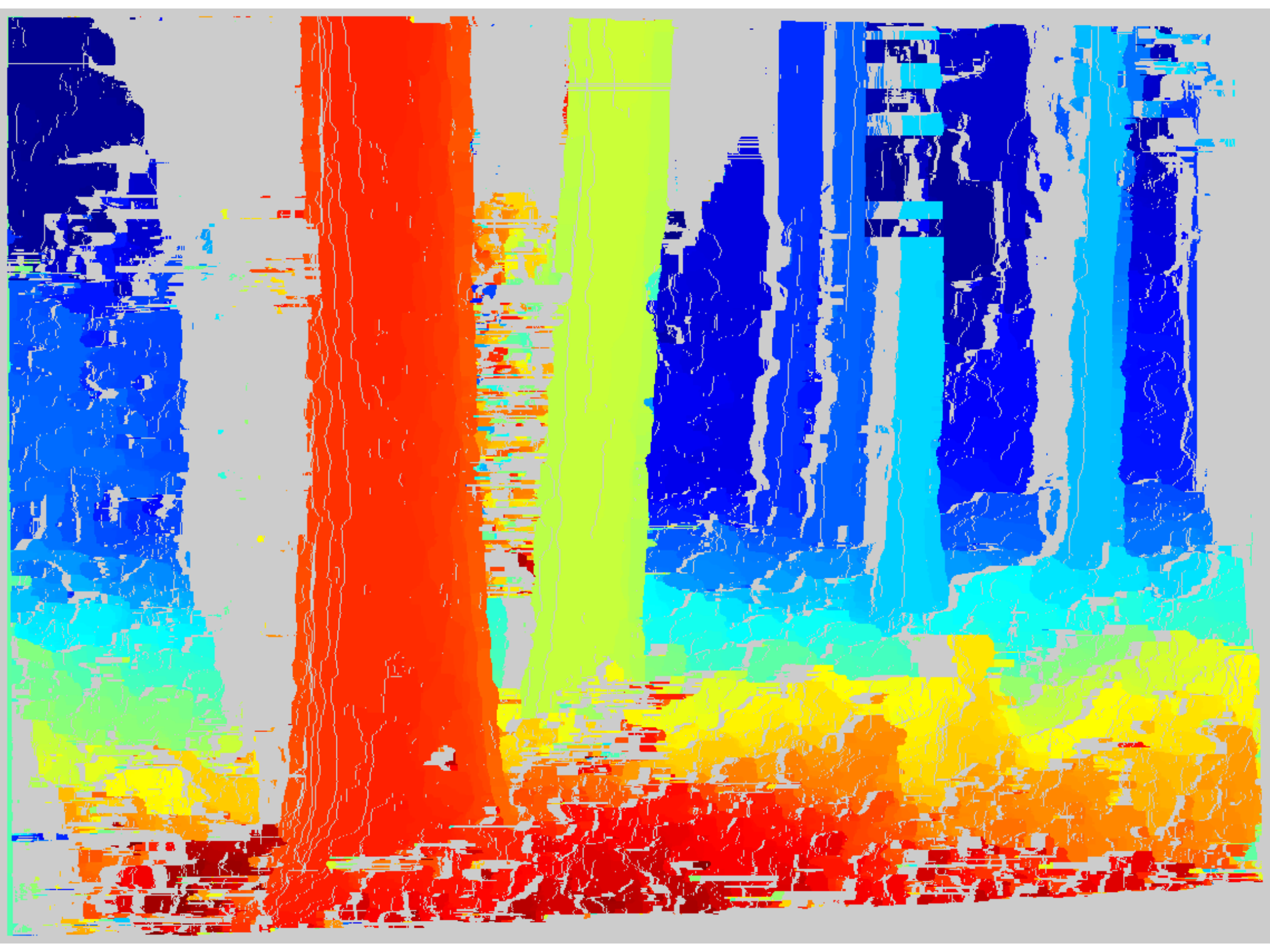

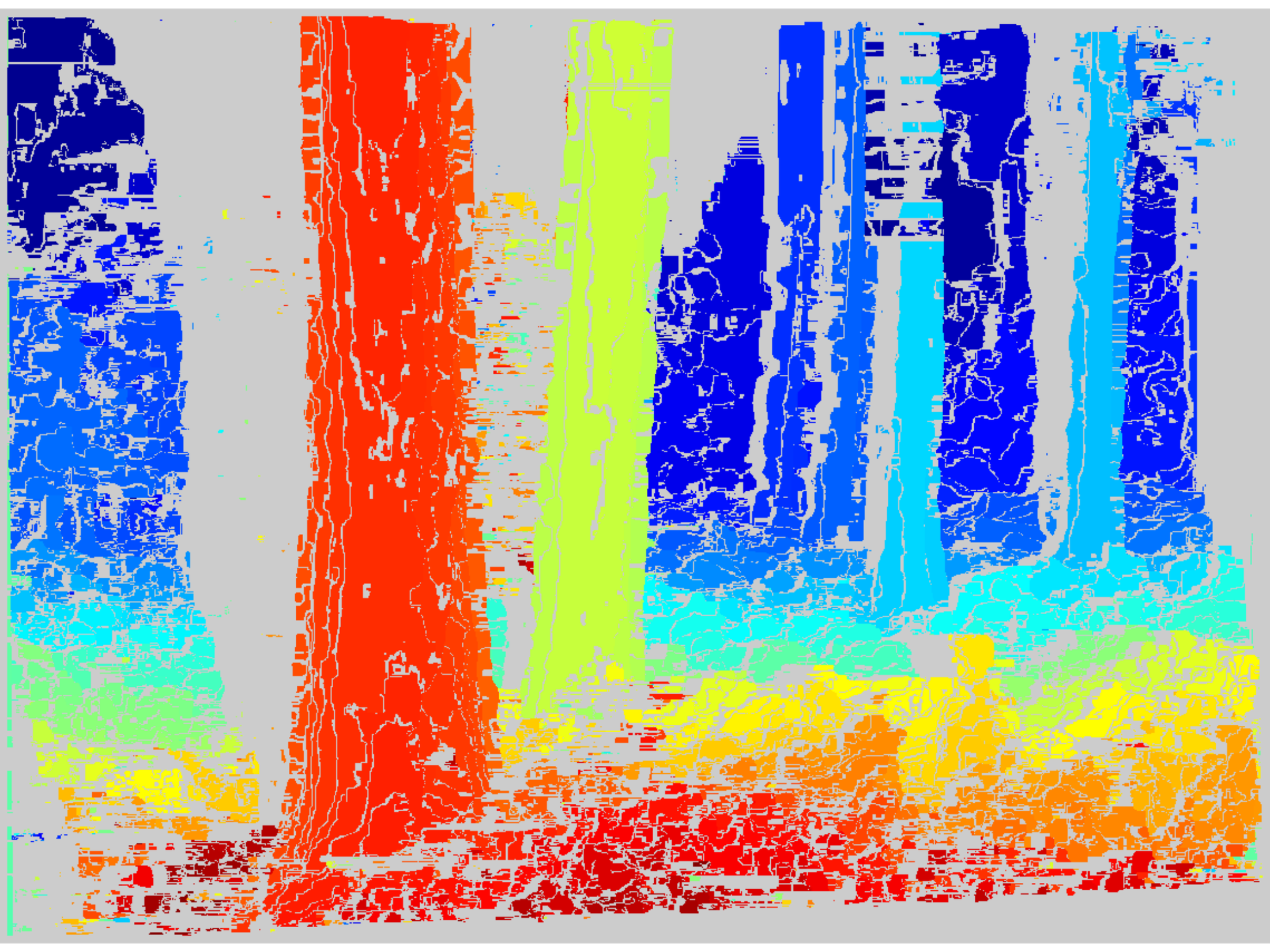

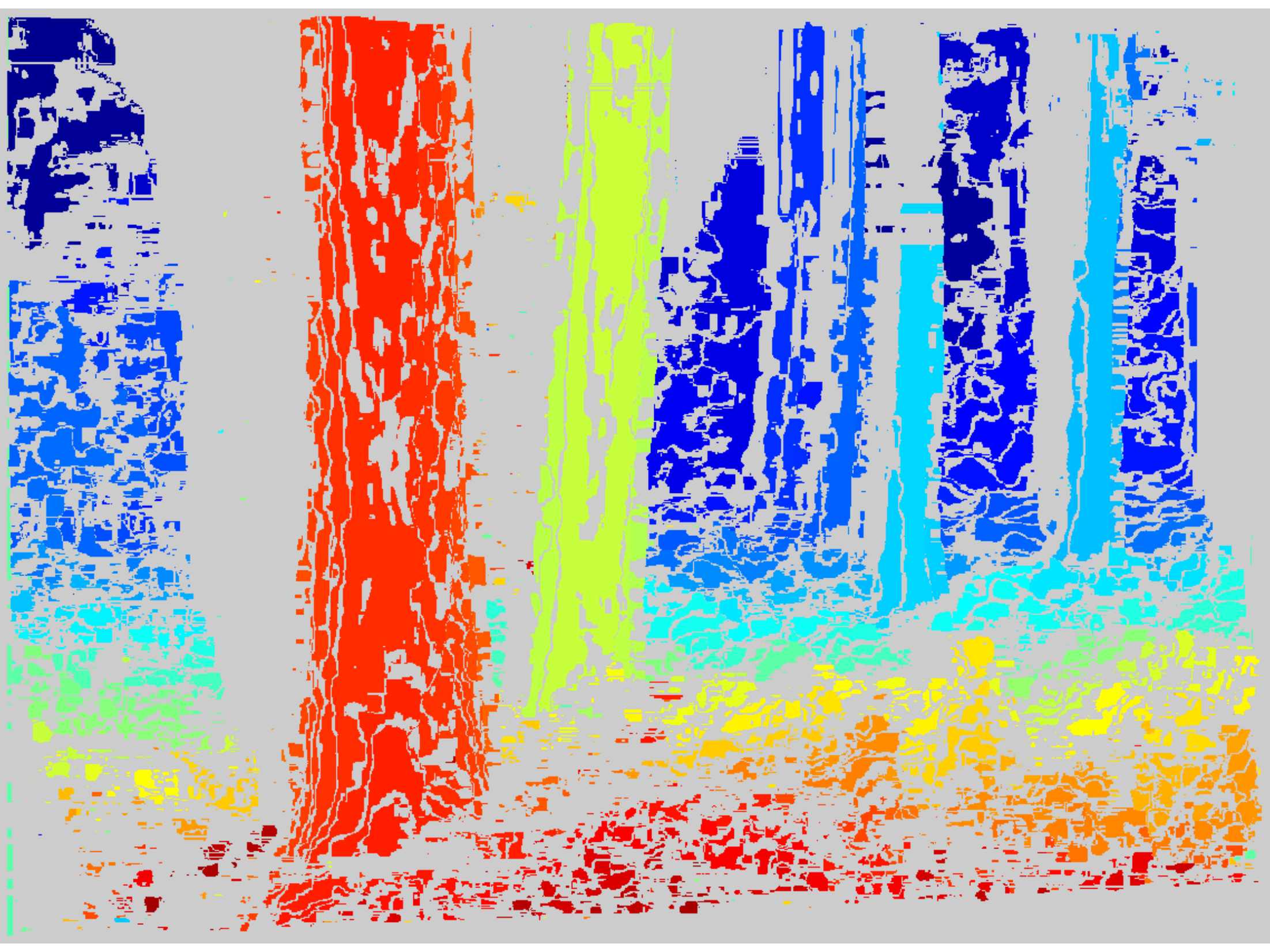

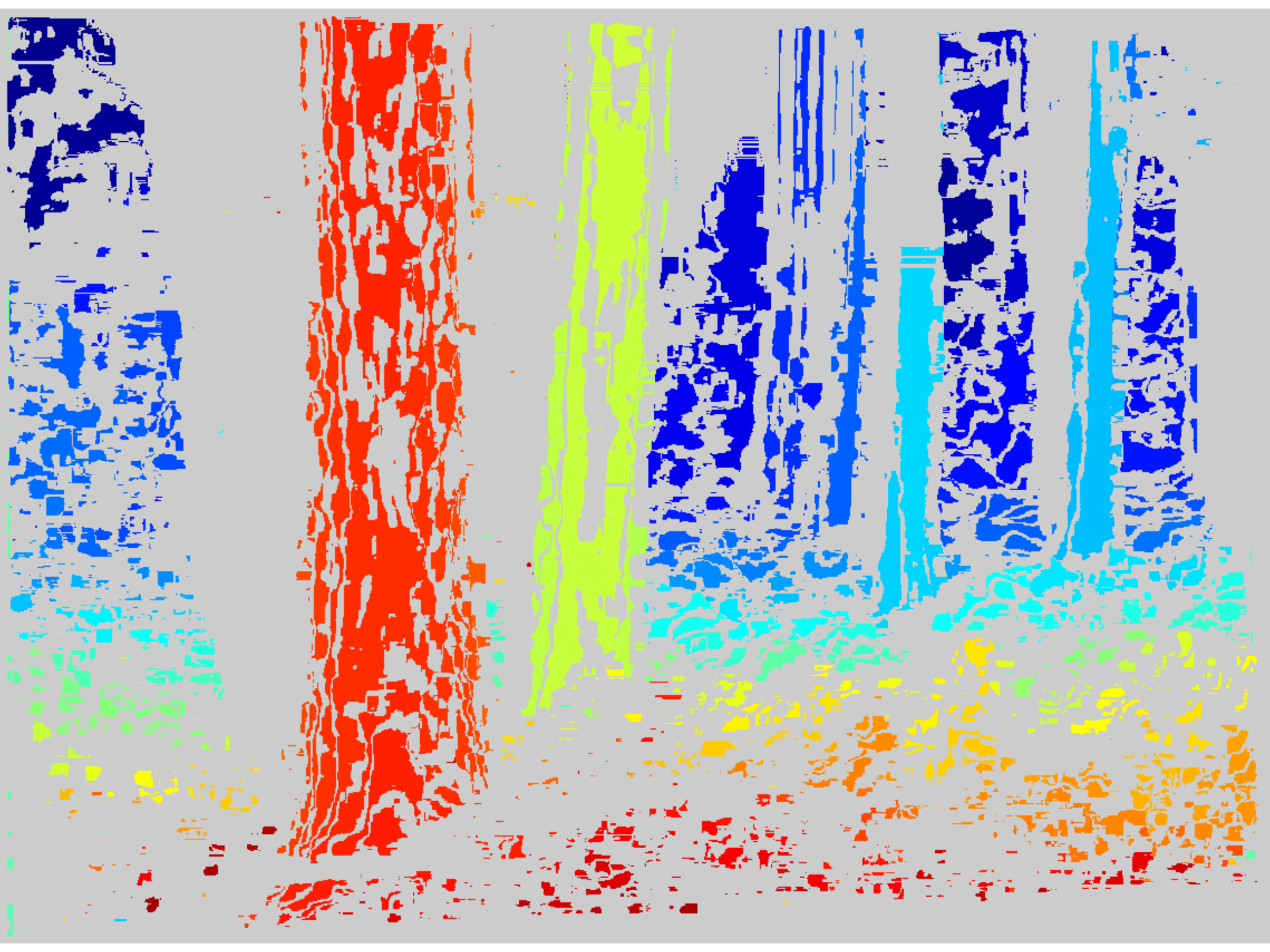

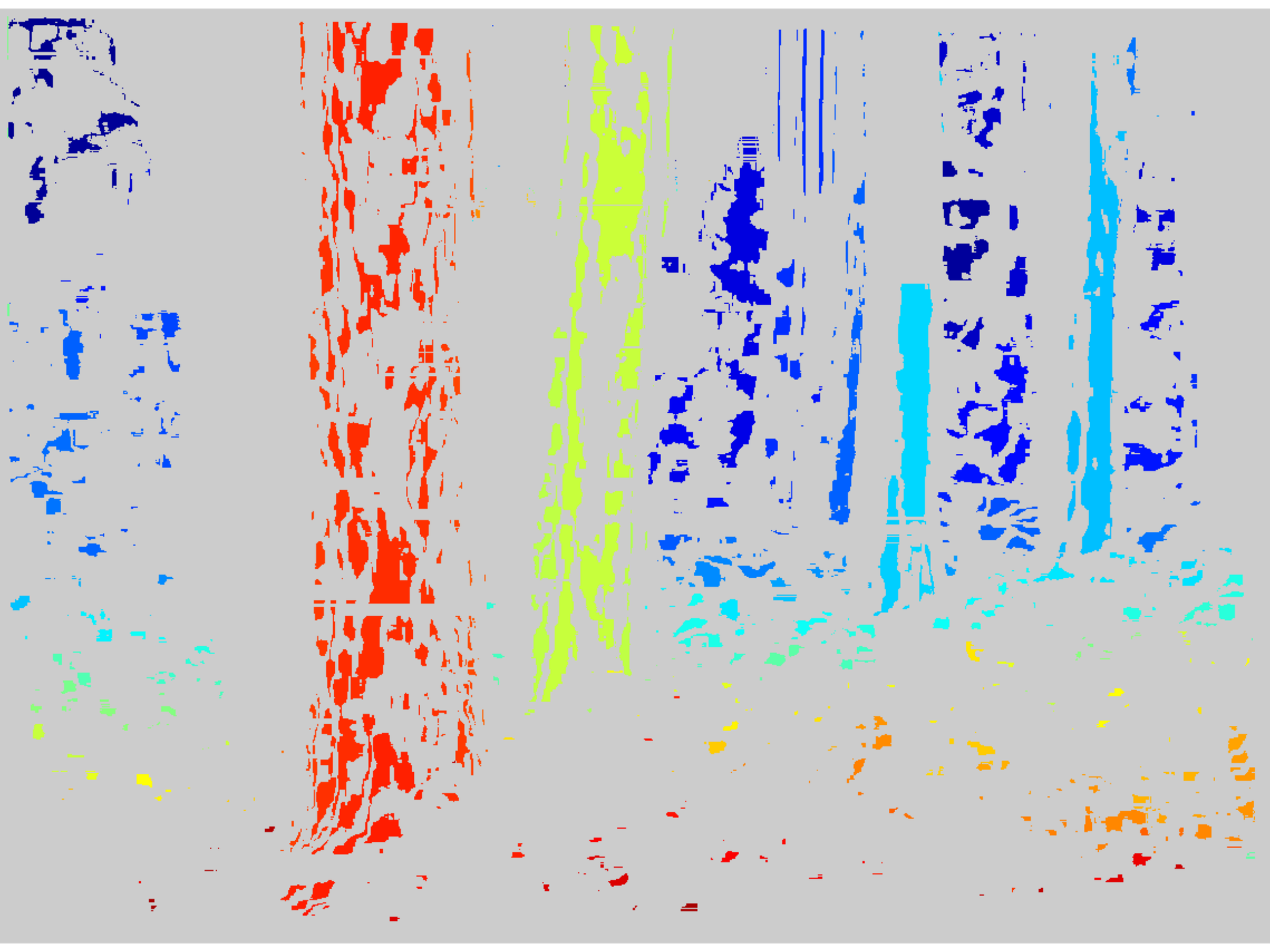

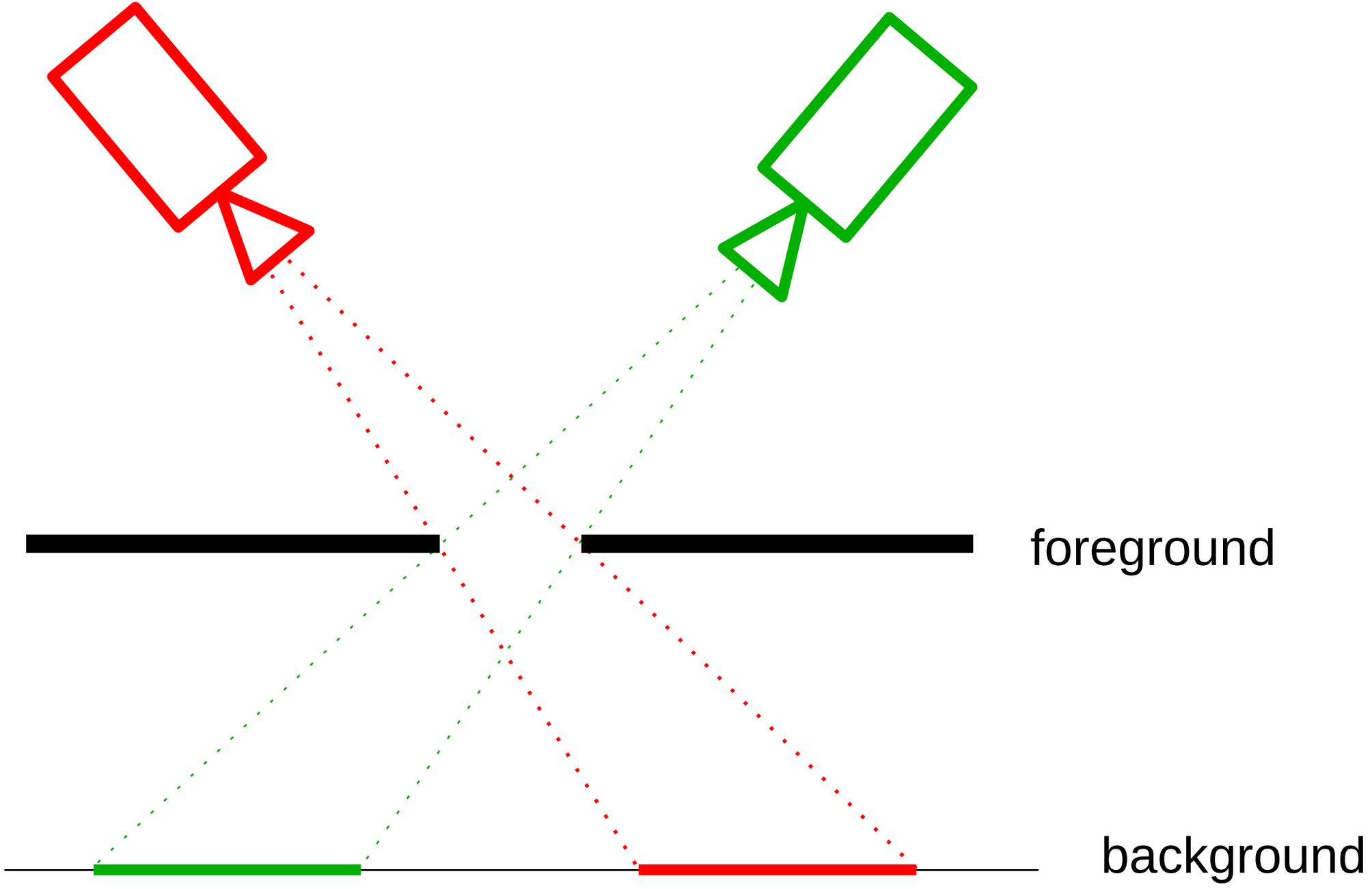
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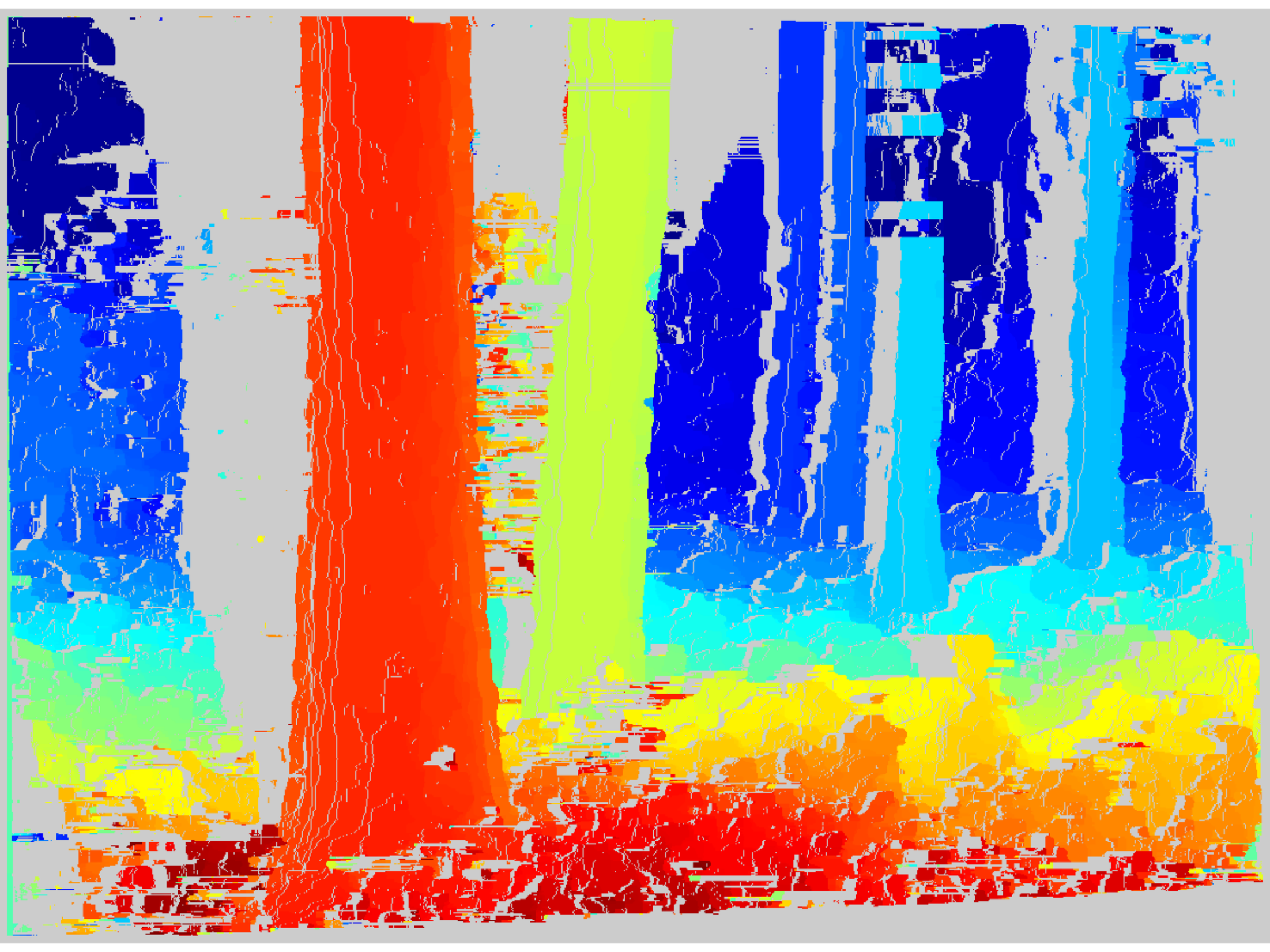

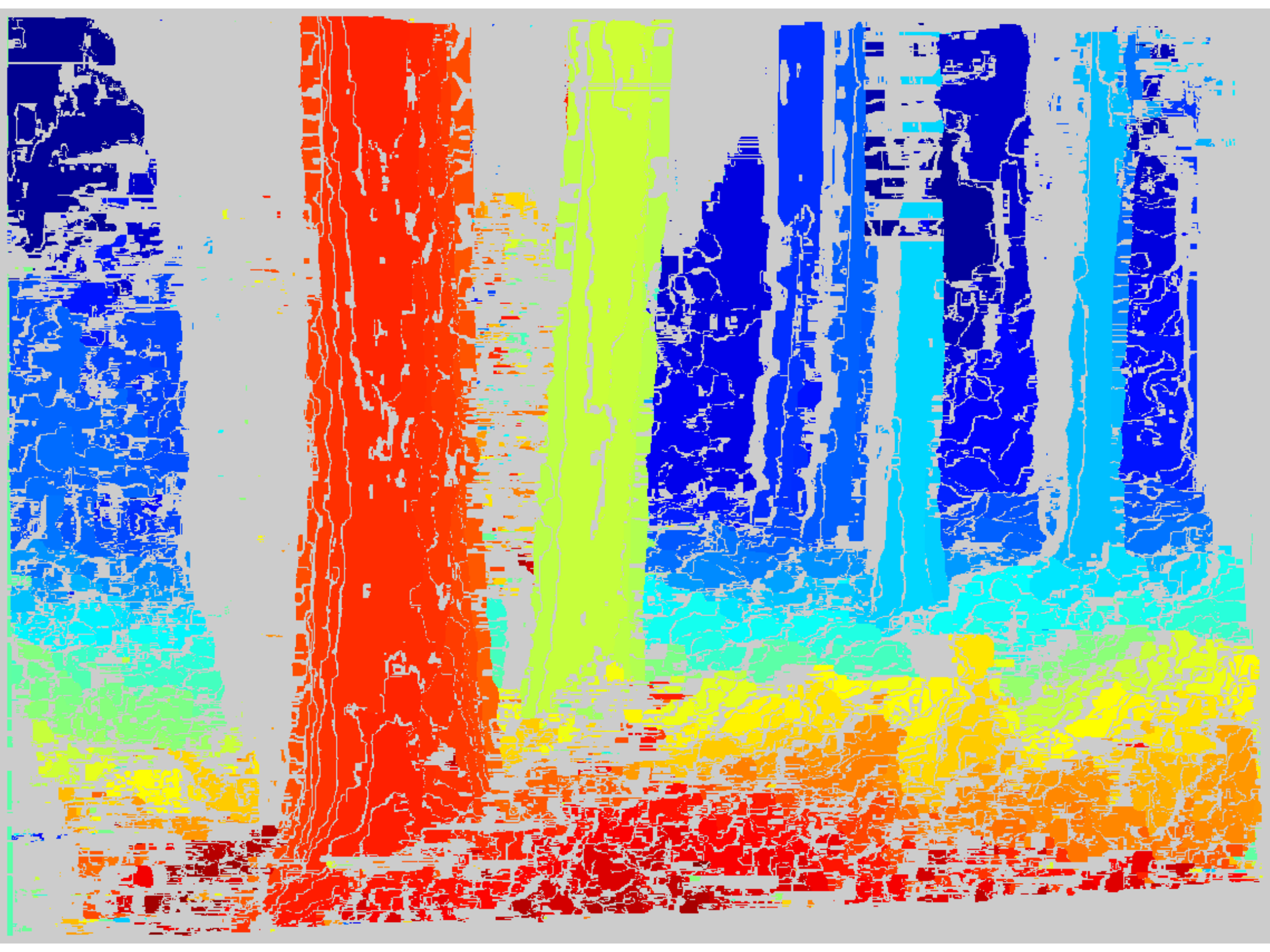

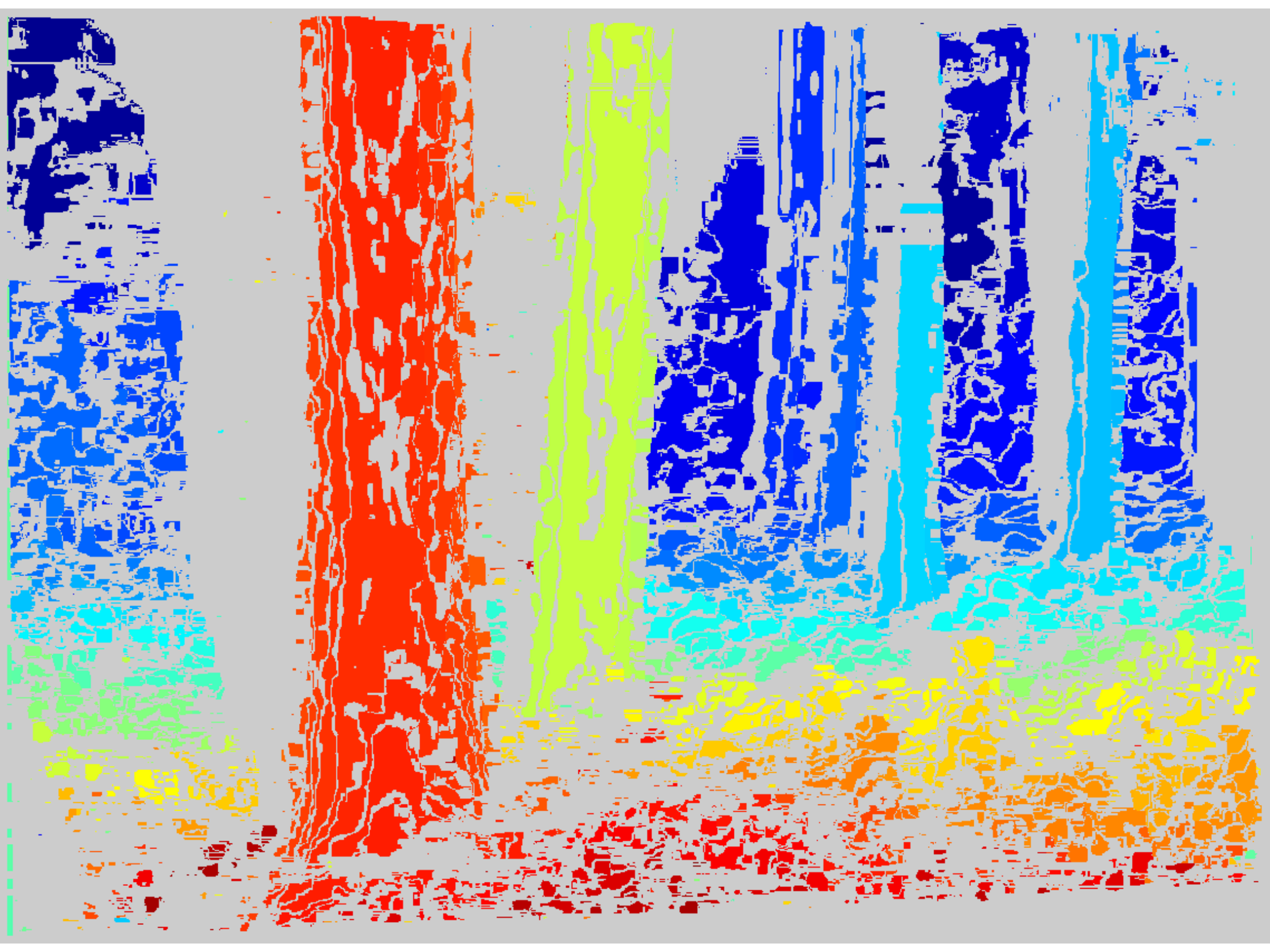

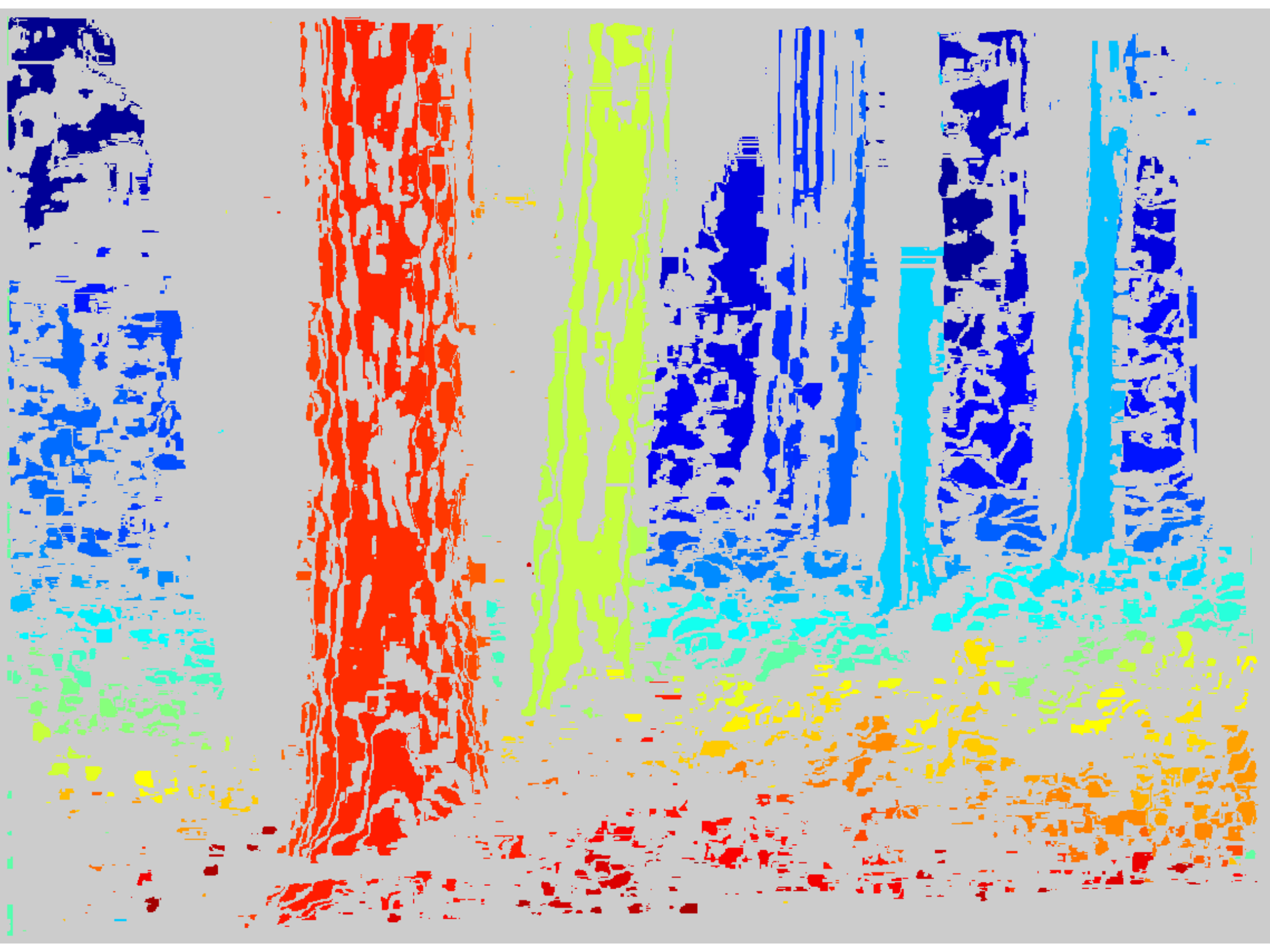

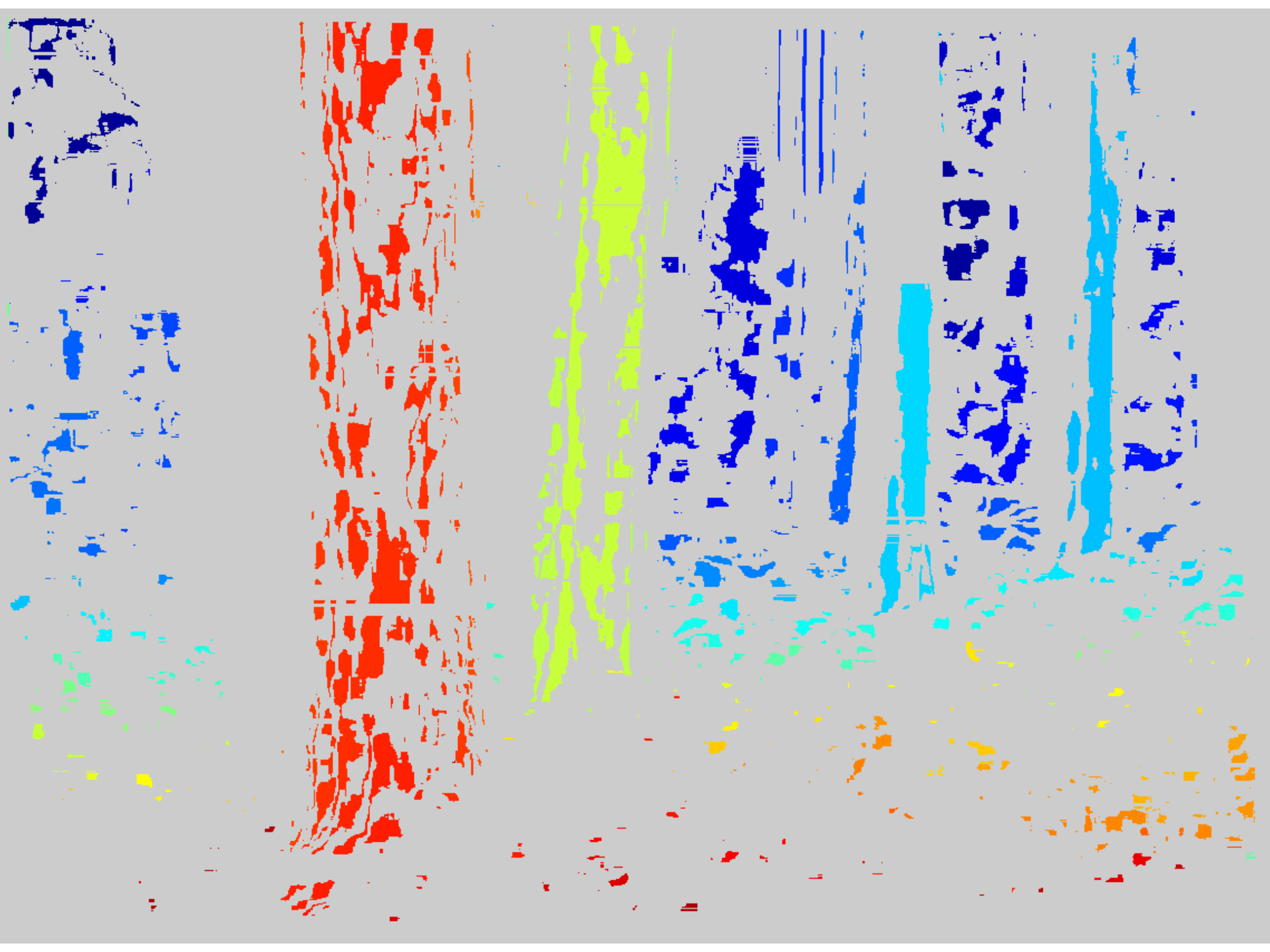

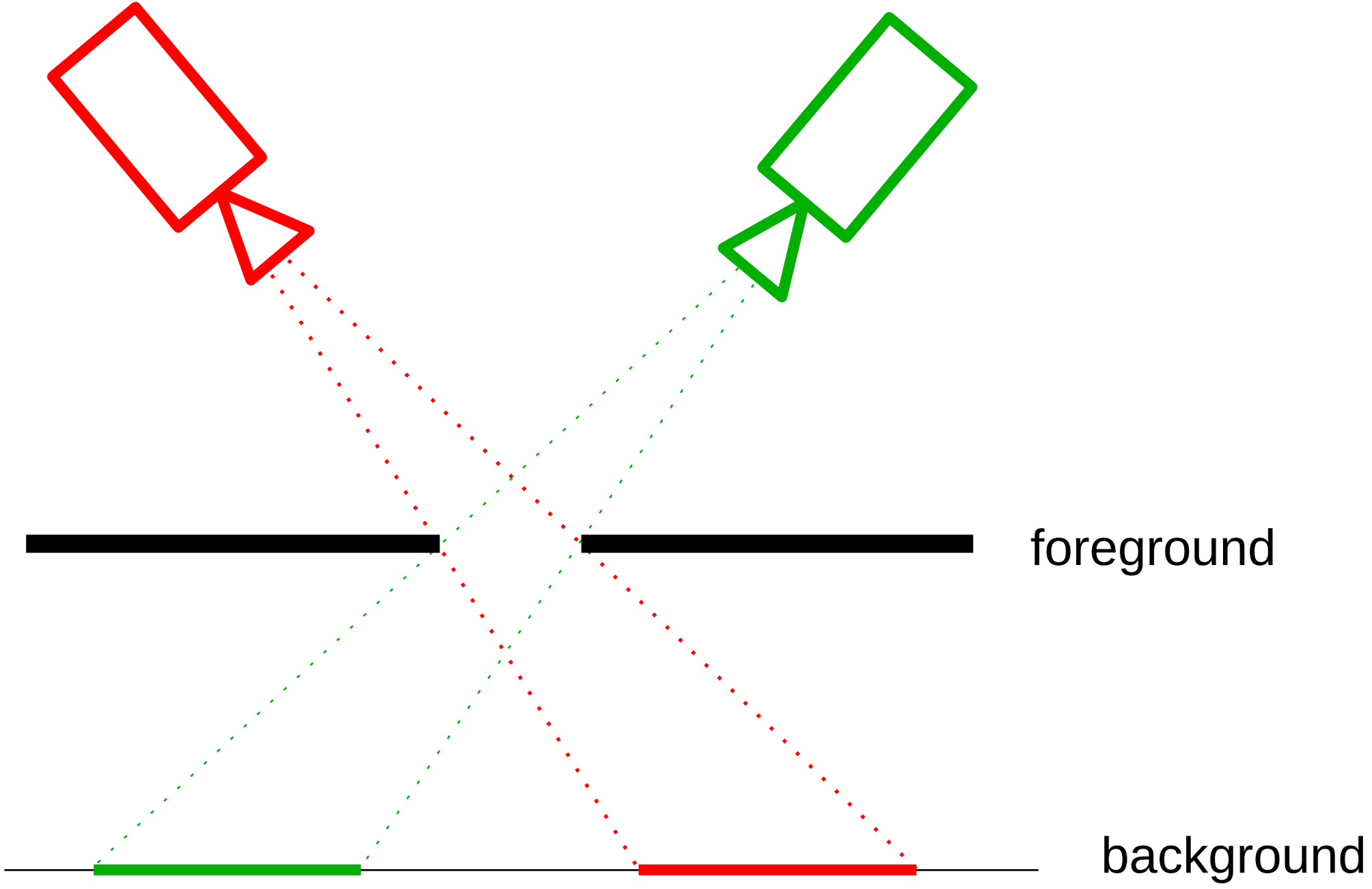
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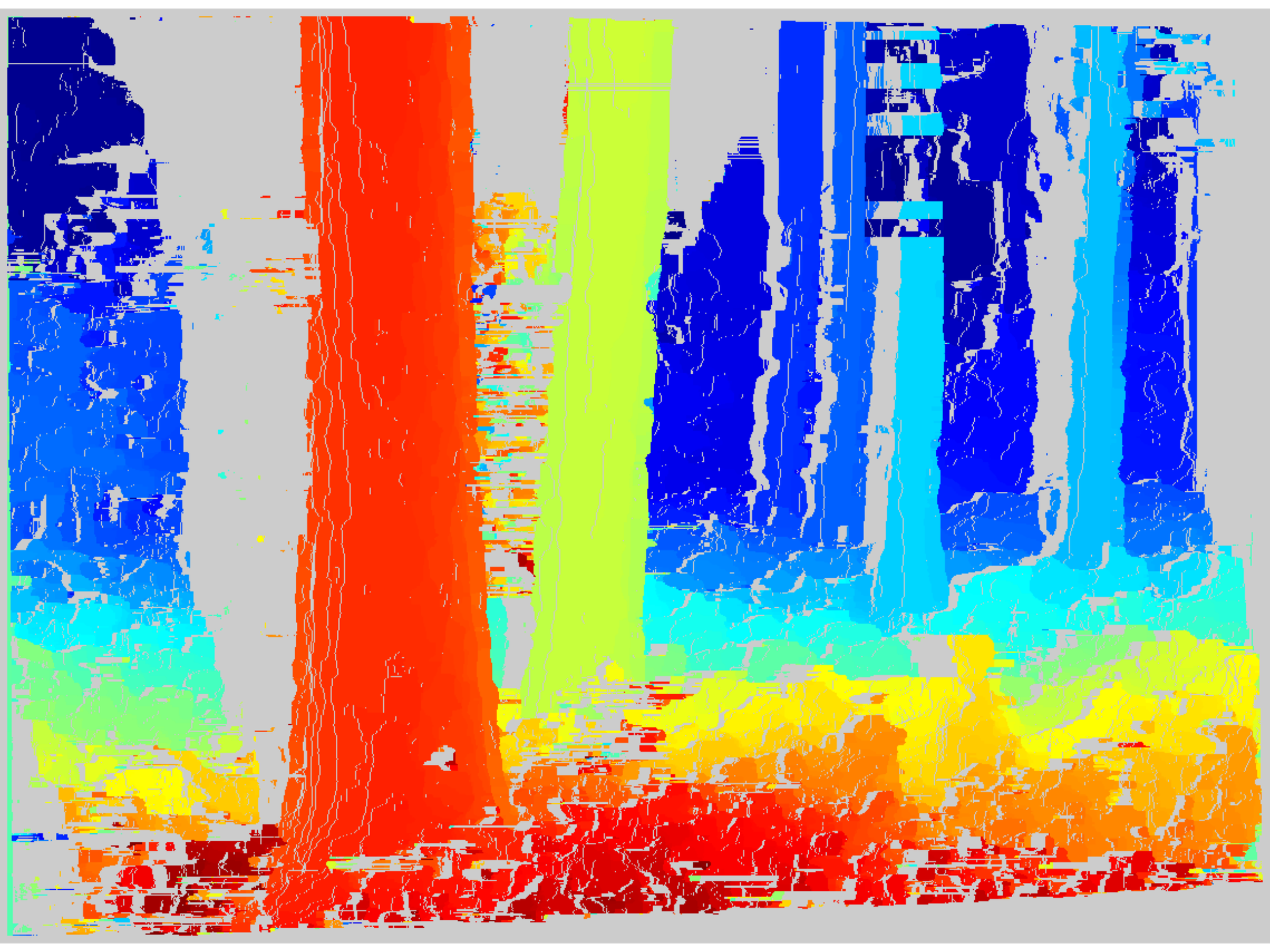

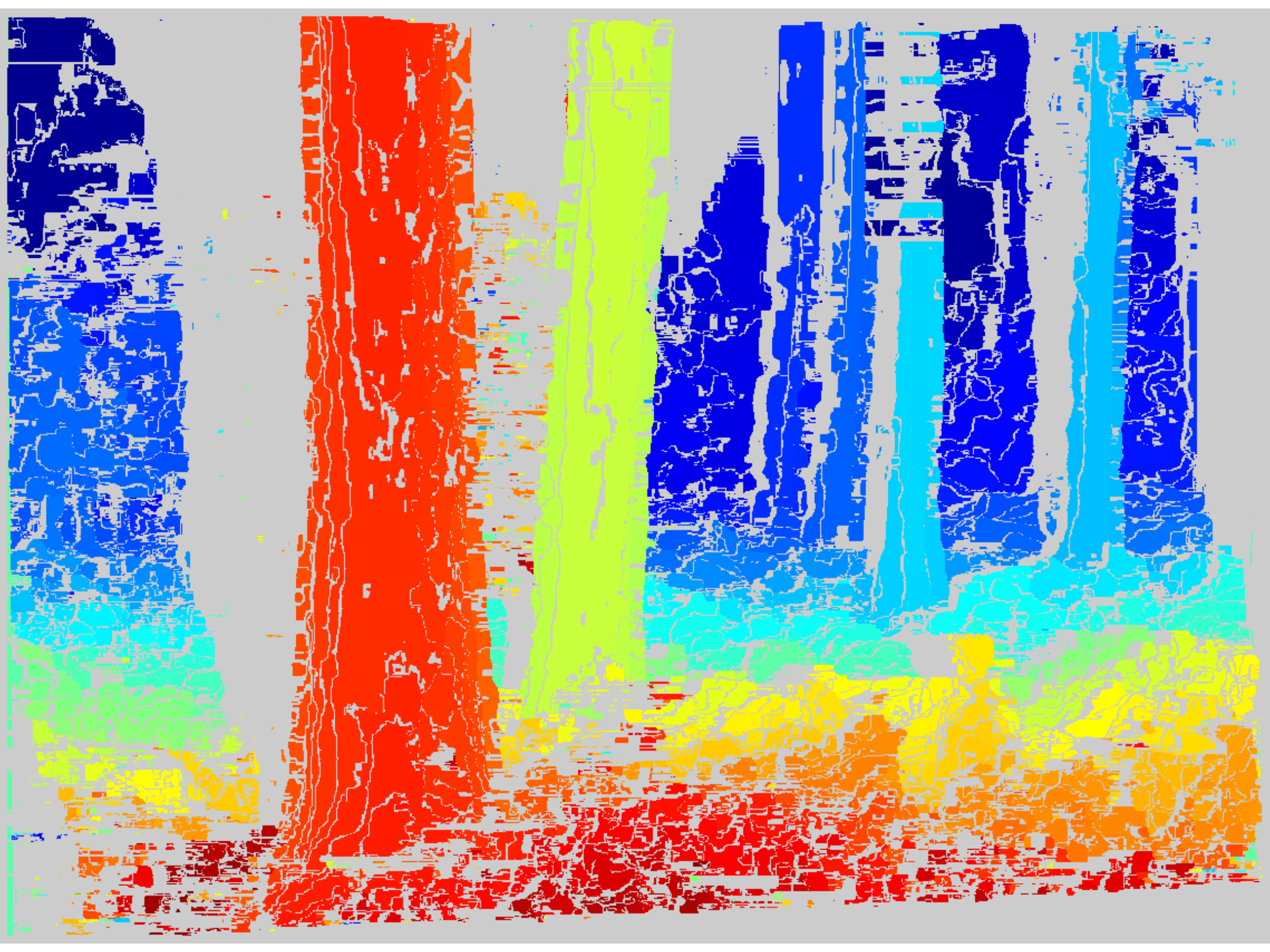

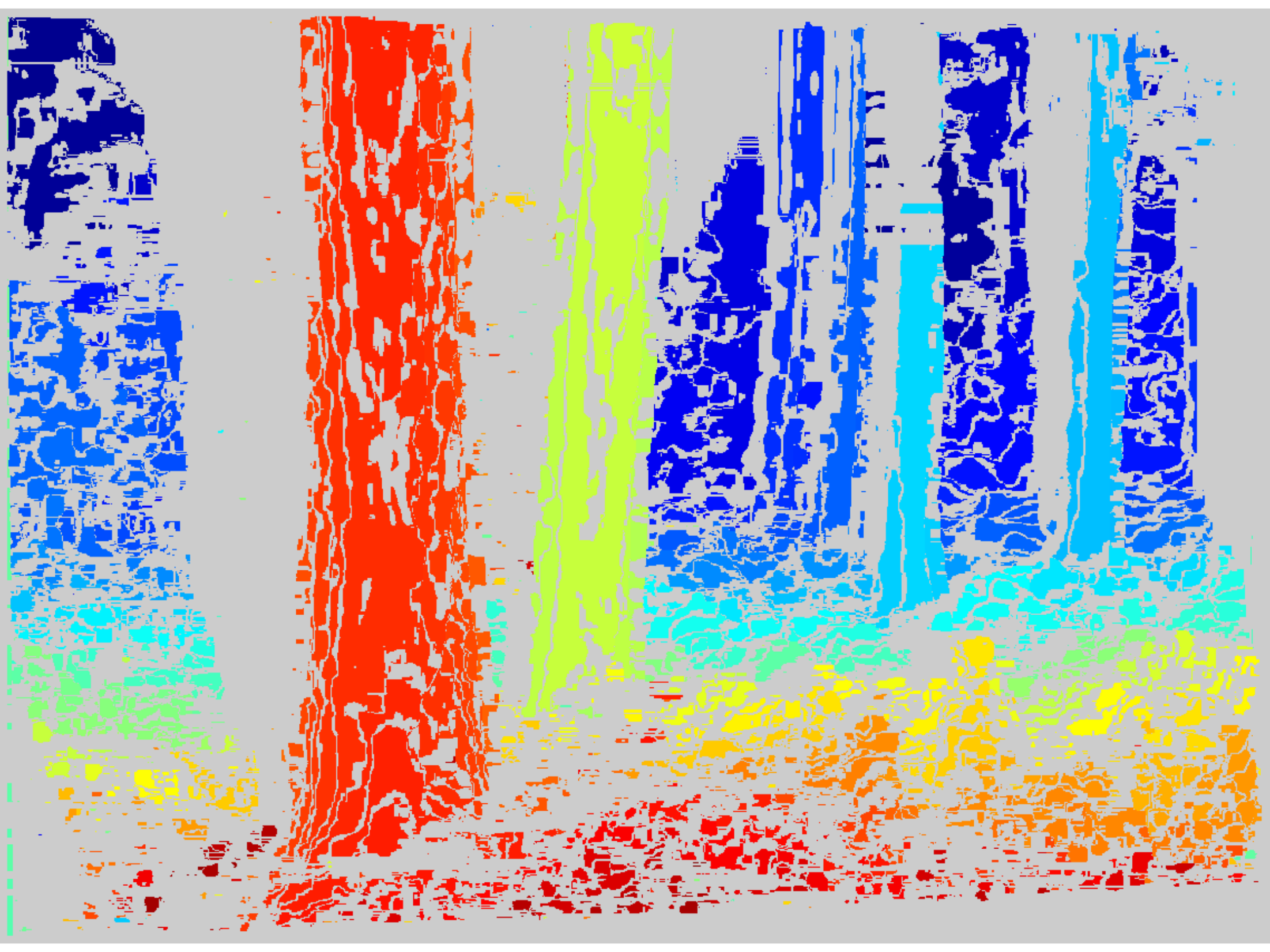

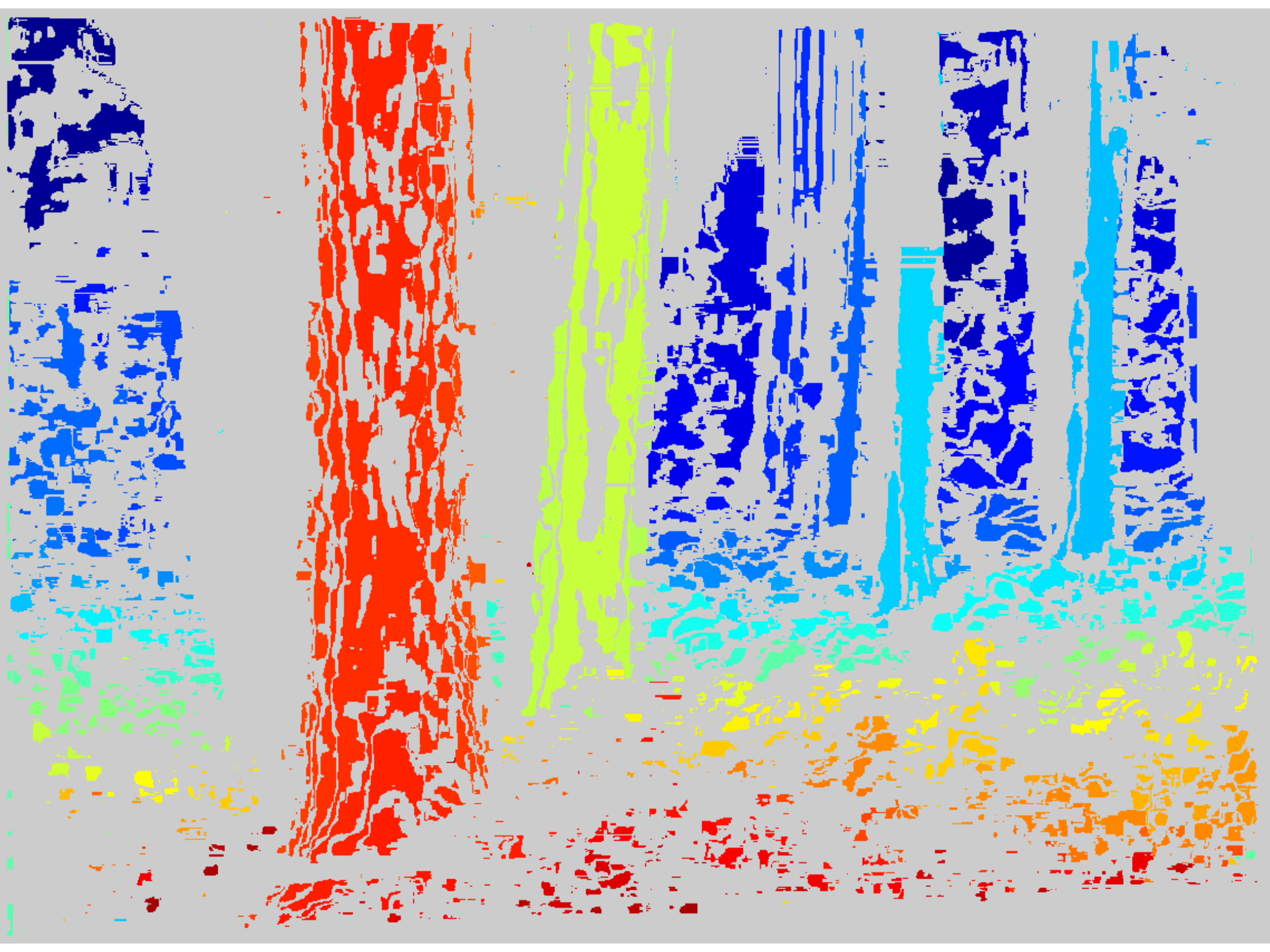

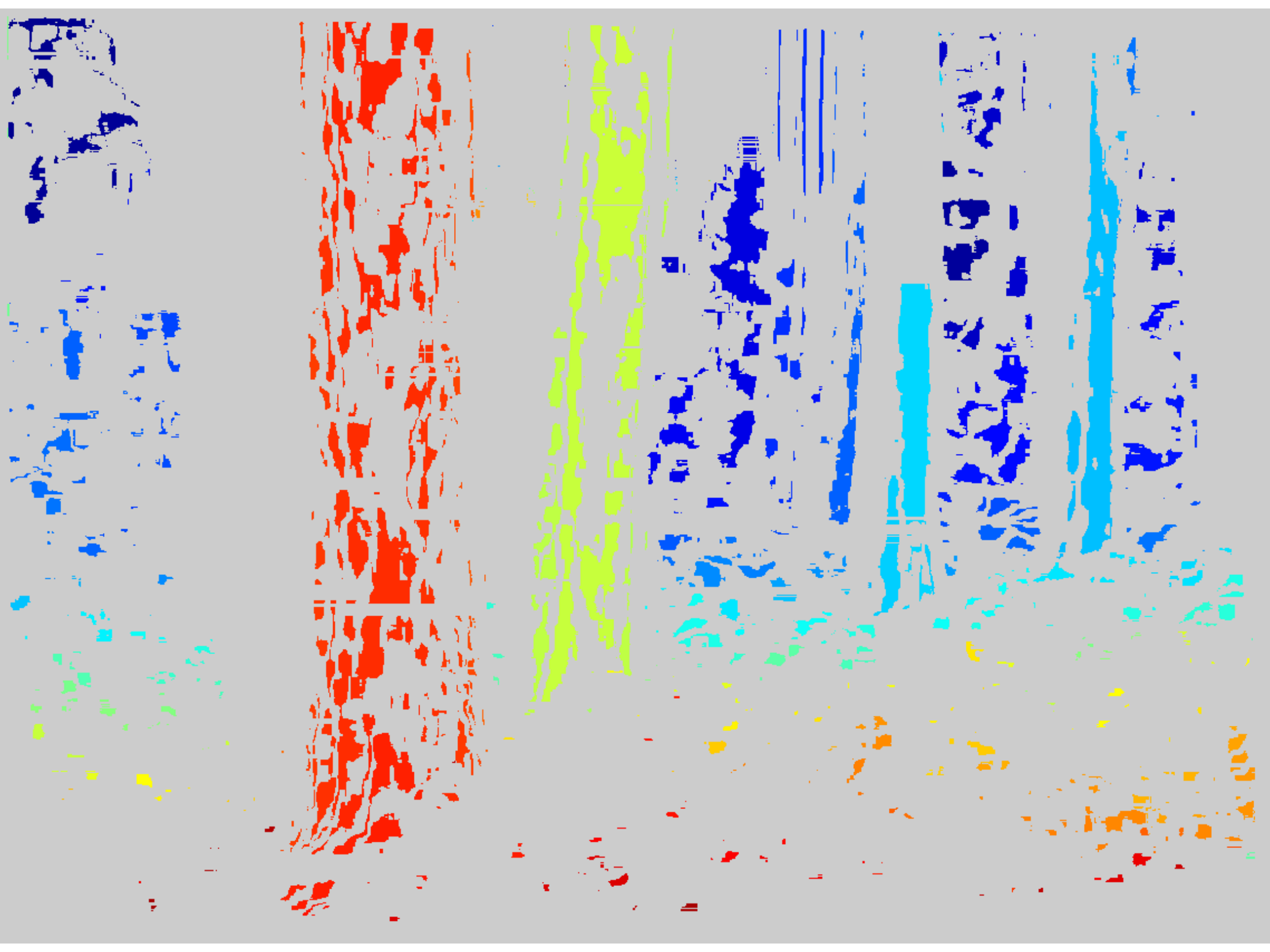

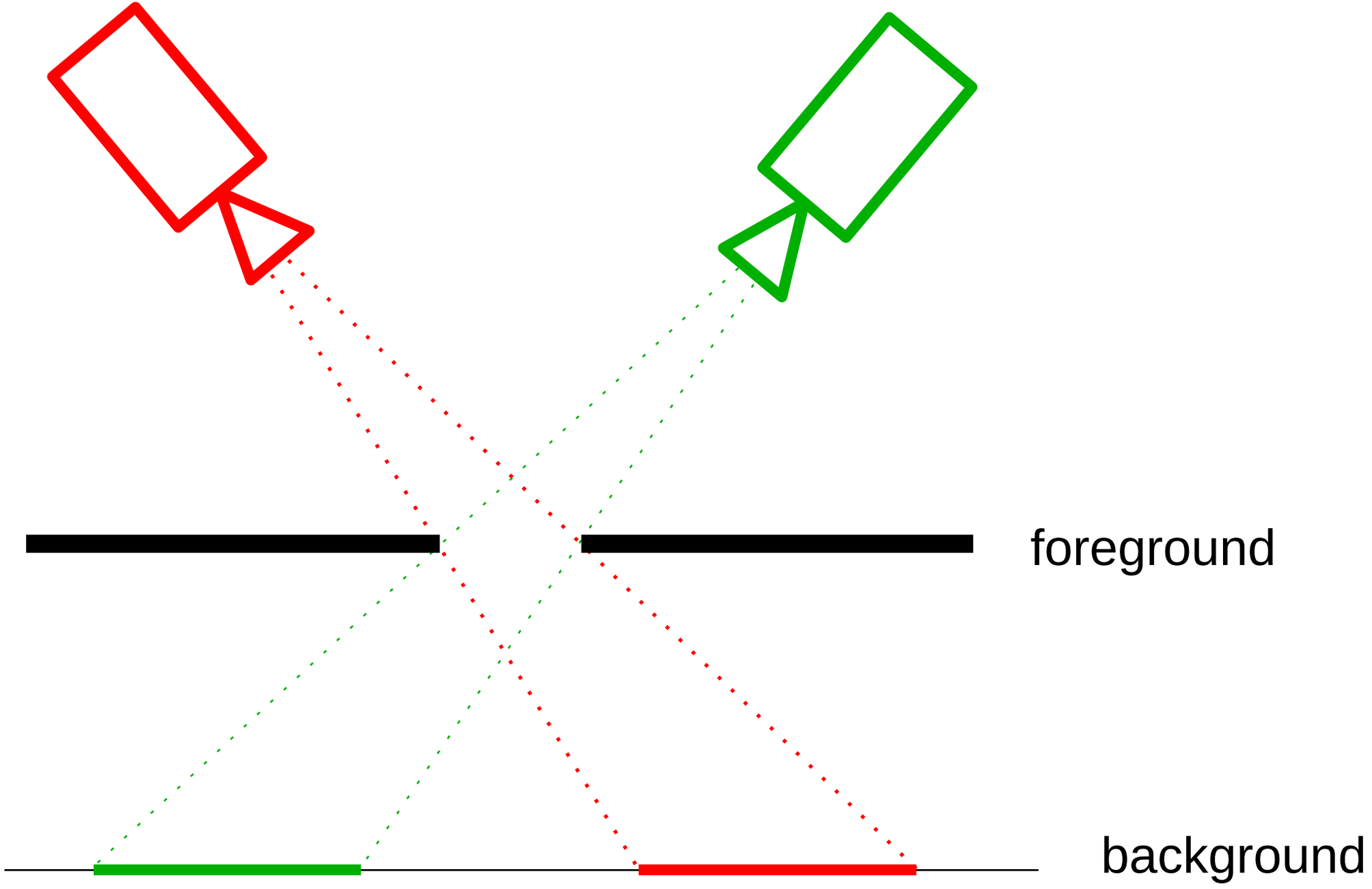
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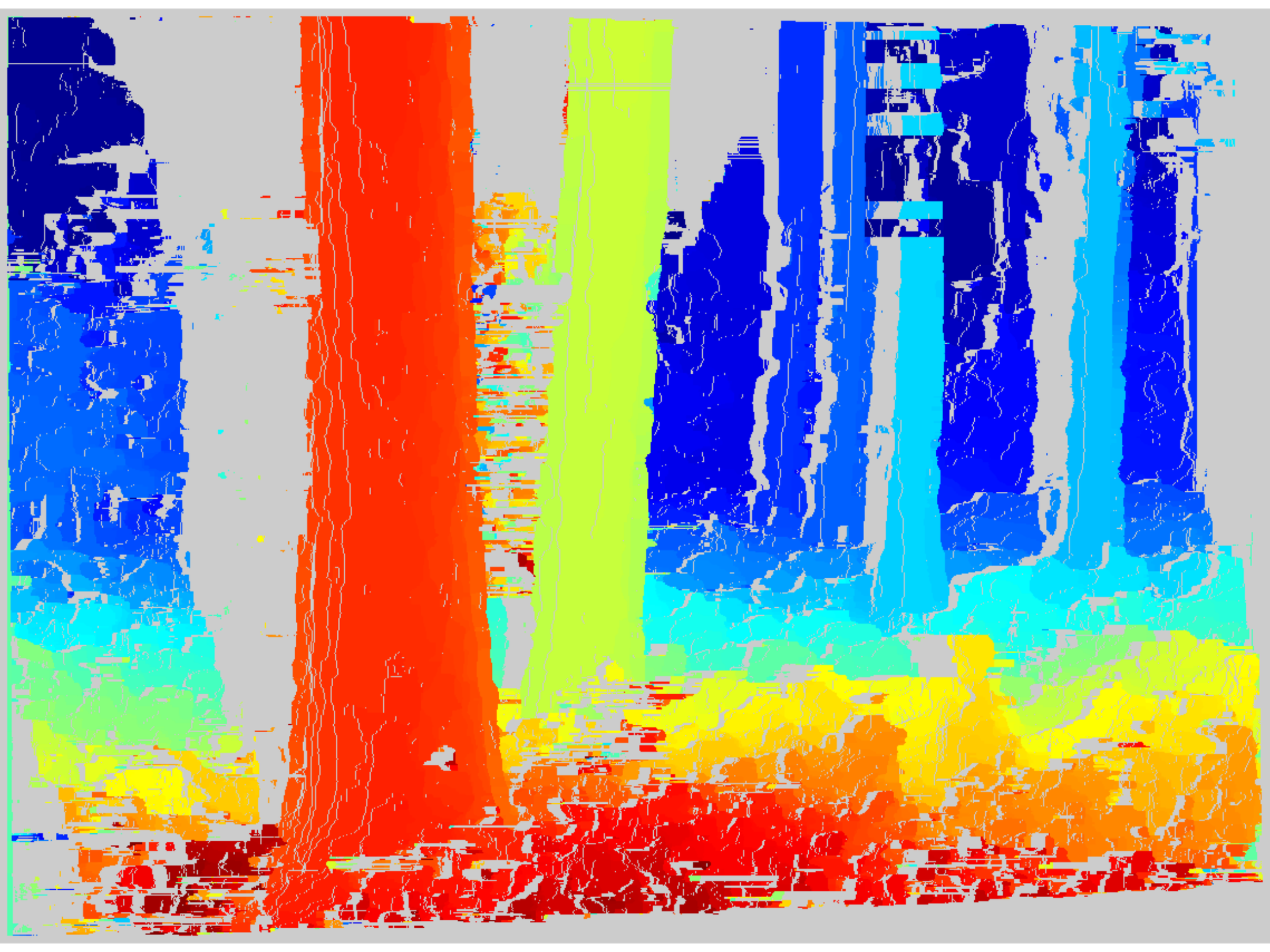

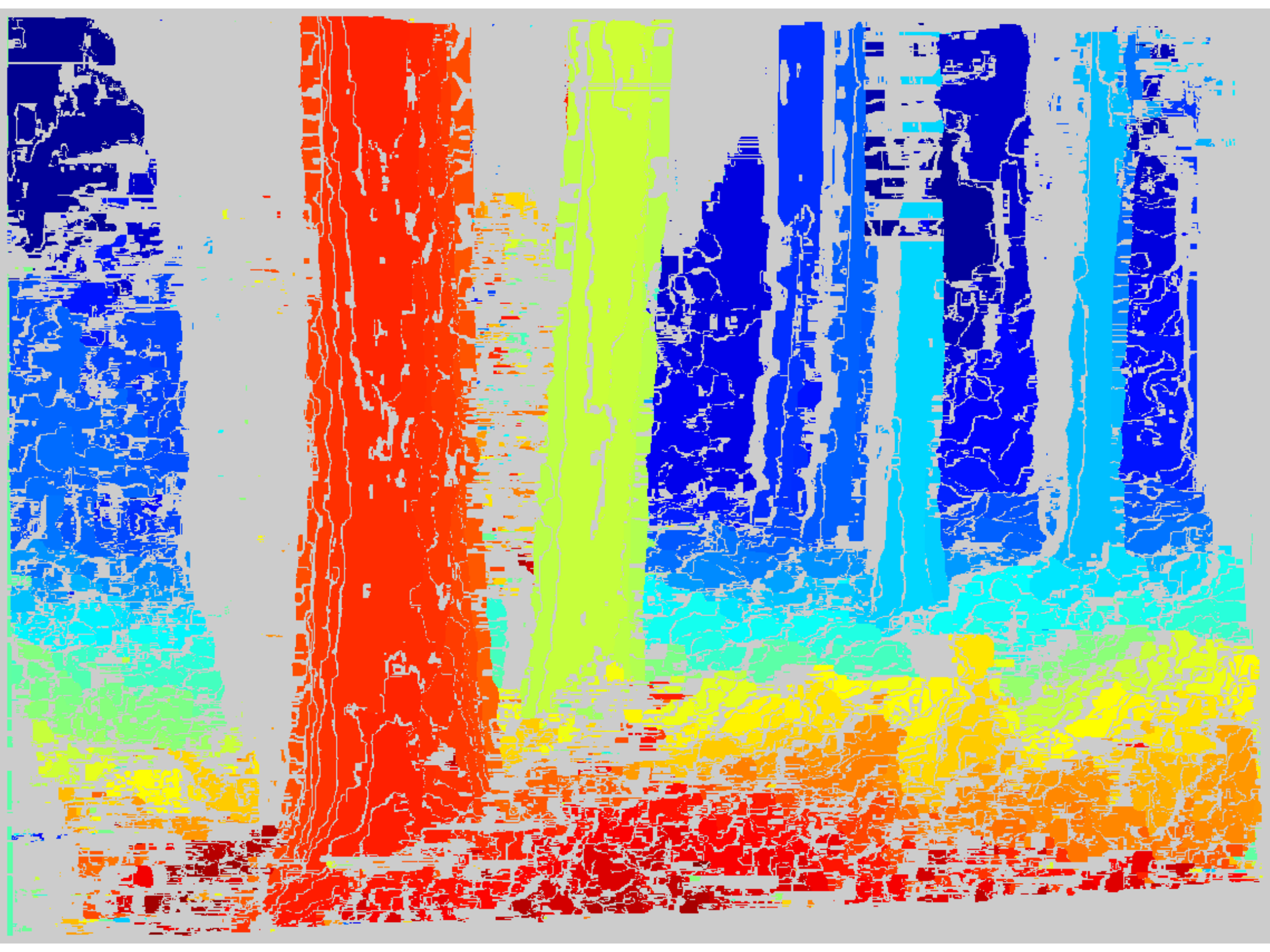

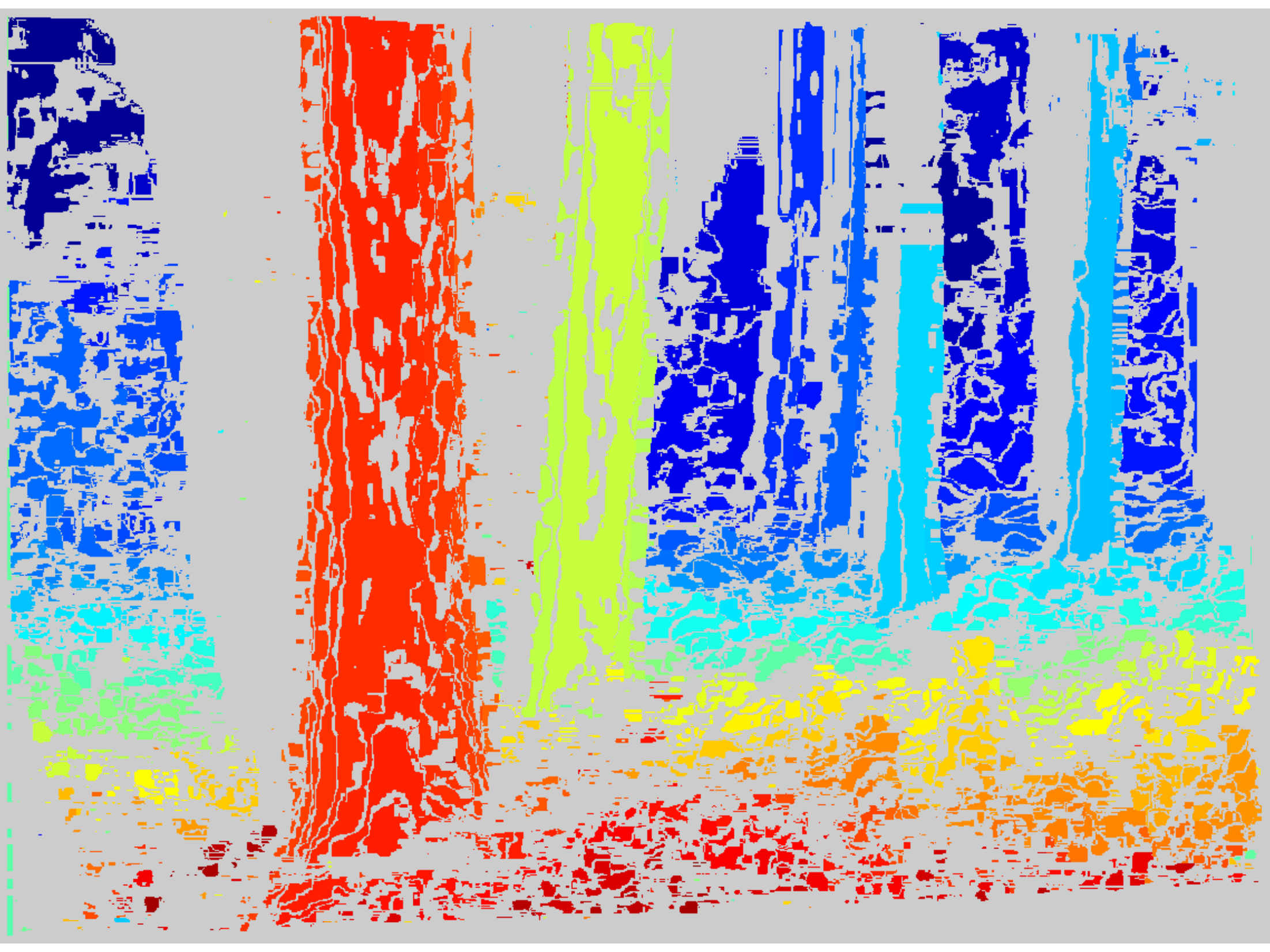

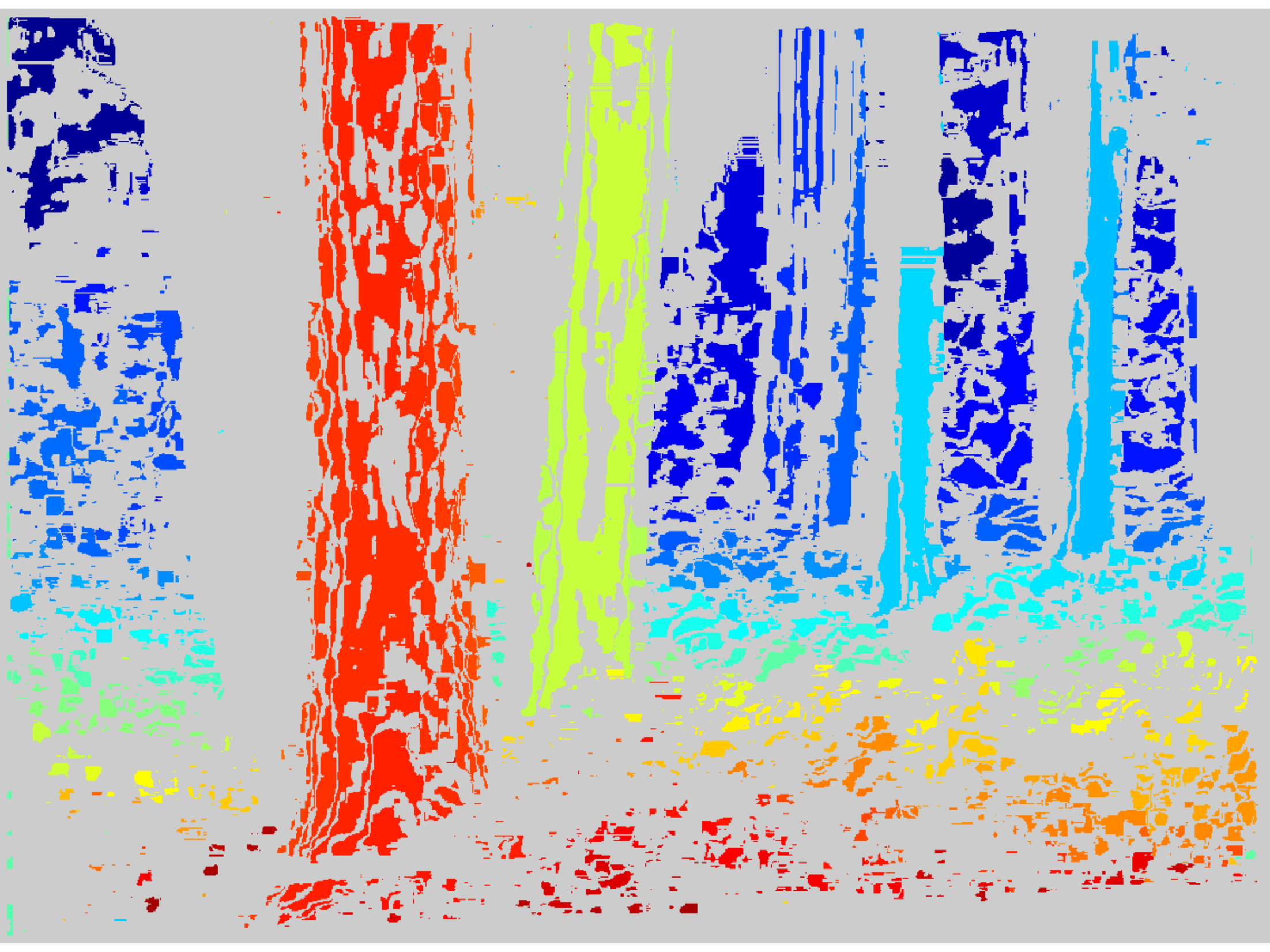

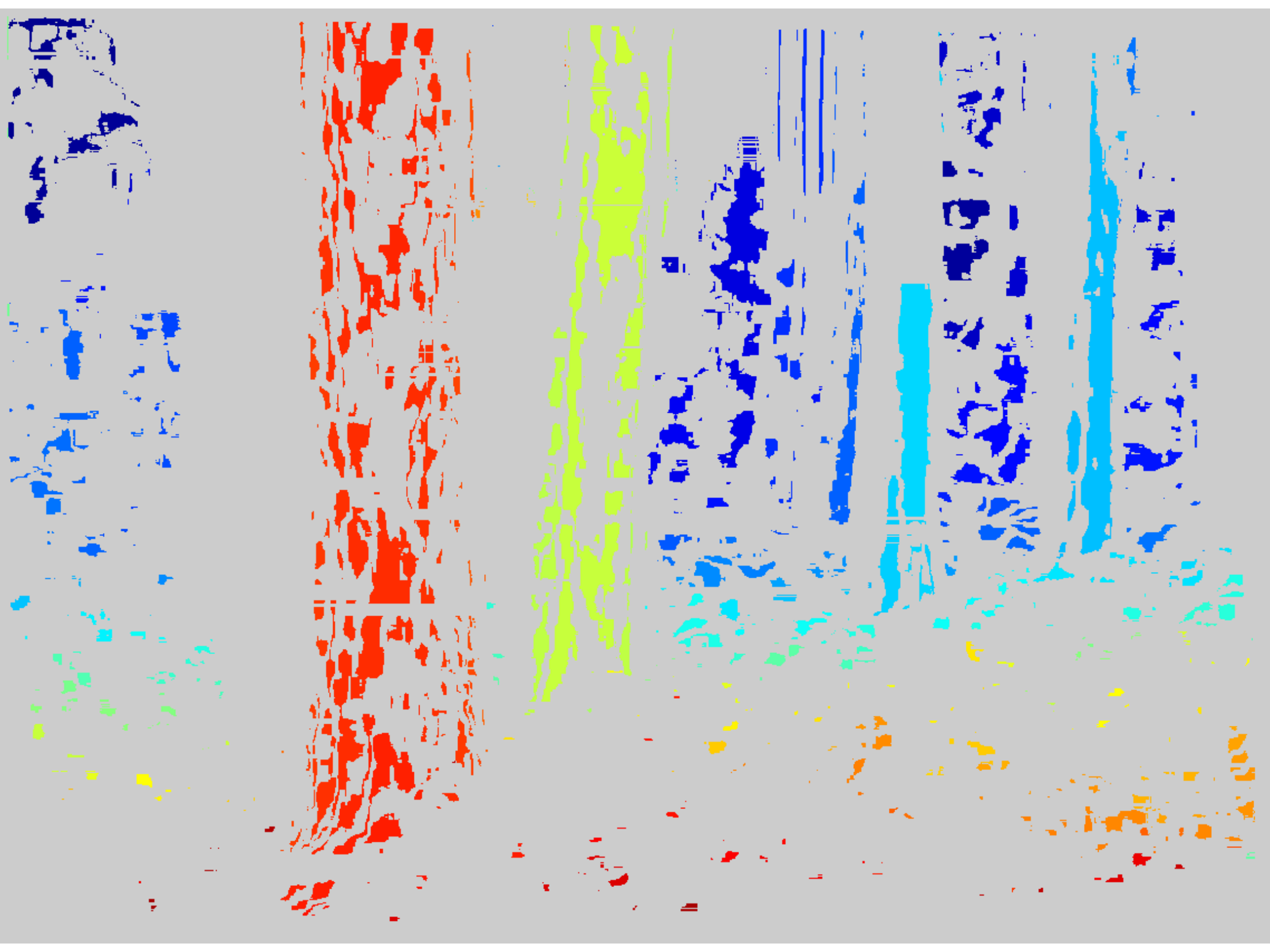

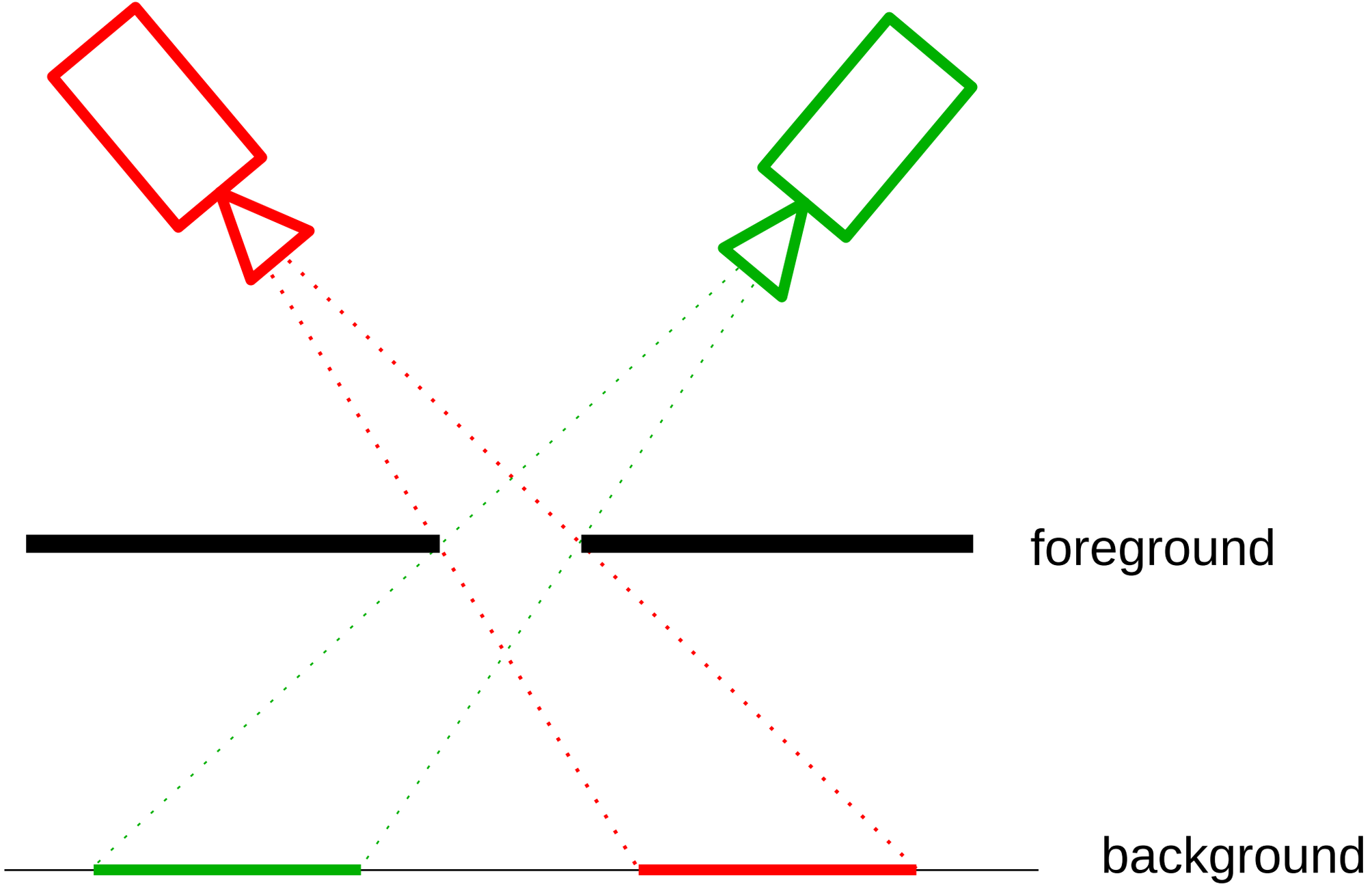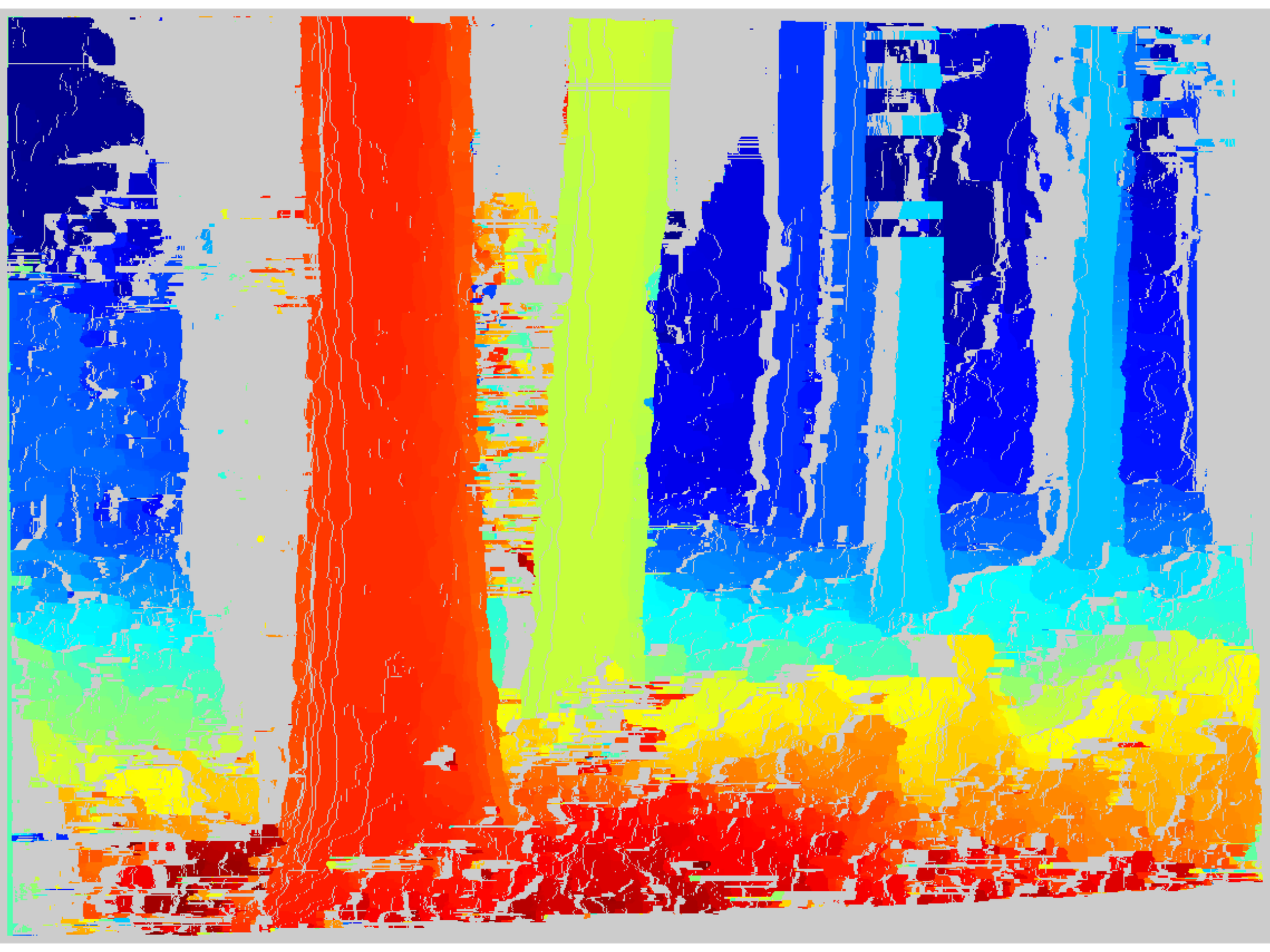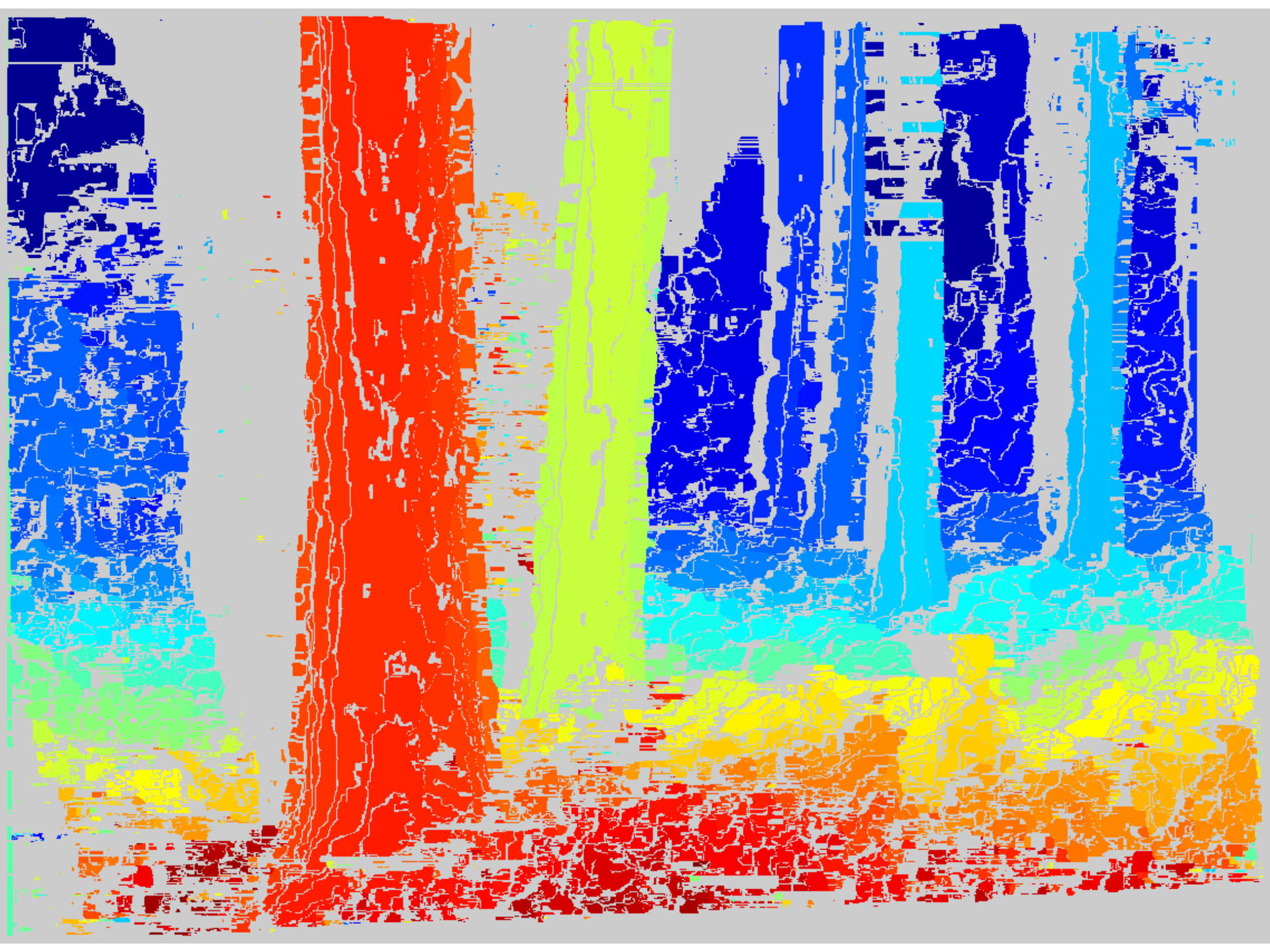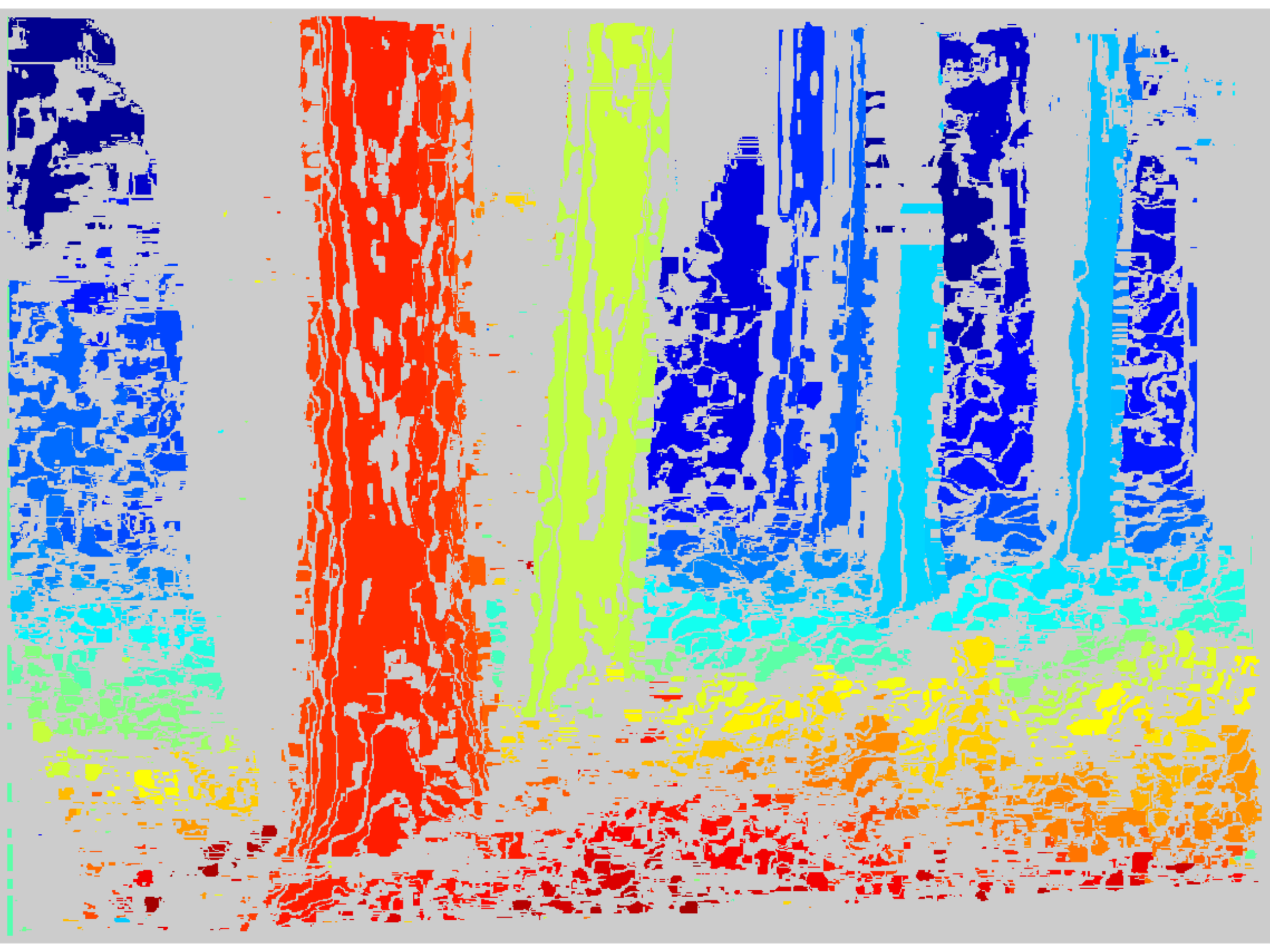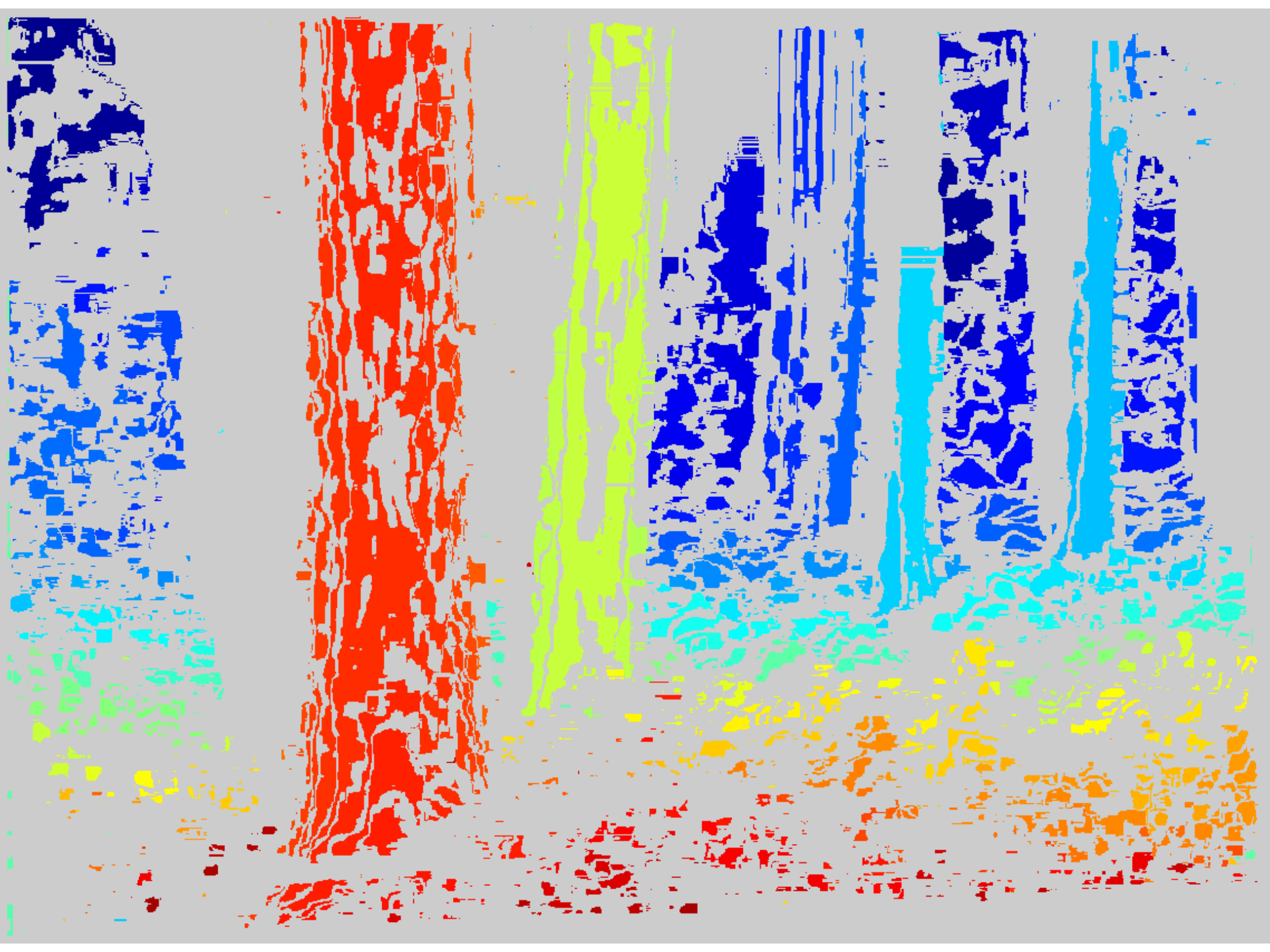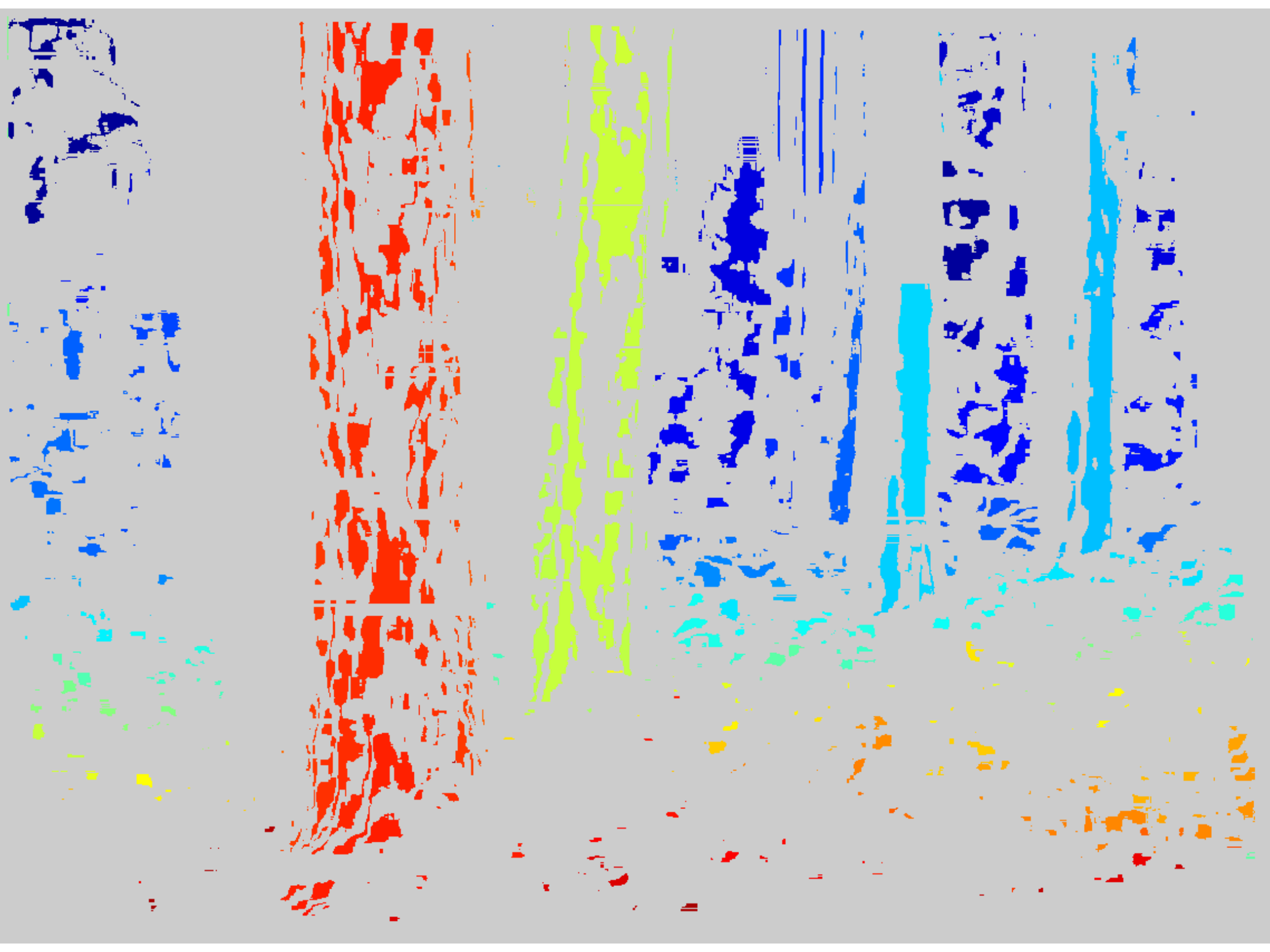
foreground
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