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Walk the Lines: Object Contour Tracing CNN for Contour Completion of Ships

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Introduction

- Motivation
- Object Contour Detection and Post-Processing
- Walk the Lines
 - Functionality
 - Contour Completion

• Evaluation

- WtL contours
- Binary WtL
- Conclusion



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- Usage: shape description, classification, identification



- To: analyze them by methods like Fourier descriptors
- Usage: shape description, classification, identification
- Project requirements and simplification: focus on ship shapes

Introduction Object Contour Detection





(a) Original von https://unsplash.com

(b) Object Contour Detection by RCN



Introduction Post-Processing





(a) Non-Maximum Suppression (NMS)



Alternative to the NMS

To create connected contours



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Solution idea

- CNN-driven contour tracing method
- CNNs are rarely used for this



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Walk the Lines Functionality





Walk the Lines Functionality



Id.	Layers	Kernel Size	Output Size
1	Input Layer	-	13×13×4
2	Conv1, BN, ReLU	3x3x4x64	13×13×64
3	Conv2, BN, ReLU, Pool	3×3×64×128	6×6×128
4	Conv3, BN, ReLU, Pool	3×3×128×256	3×3×256
5	Conv4, BN, ReLU	3x3x256x512	3×3×512
6	Conv5, BN, ReLU	3×3×512×1024	1×1×1024
7	FC, MSE	1×1×1024×1	1

Standard Regression CNN



Walk the Lines Functionality





Single tracer



Walk the Lines Contour Completion





Several parallel running tracers (each one with one colour)



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(a) NMS

(b) WtL









(a) WtL

(b) Binary WtL



Evaluation Binary WtL











Method	Metric	1	2	3	4	5	6	7	8	9	10	Ø	$\emptyset_{1,2,6,8}$
Binary WtL	1. cl. sh.	yes	yes	OL	DL	WL	yes	OL	yes	OL	DL	-	-
NMS	1. cl. sh.	no	-	-									
WtL-seg	Р	94.23	93.66	77.04	91.90	84.11	86.88	72.67	82.56	73.10	91.47	82.66	88.54
	R	99.60	99.05	99.98	98.99	99.88	99.82	50.13	99.25	72.13	11.65	50.13	99.52
	loU	93.87	92.83	77.03	91.04	84.02	86.75	42.17	82.05	57.00	11.52	70.36	88.17
RN	Р	98.52	87.76	95.97	97.32	96.68	96.52	95.07	93.37	87.64	96.86	94.55	95.00
	R	88.27	94.16	95.34	93.92	92.93	90.86	88.69	89.63	93.68	78.41	90.98	90.25
	loU	87.11	83.23	91.67	91.55	90.06	87.98	84.79	84.26	82.75	76.46	86.45	86.16



Evaluation Binary WtL





(a) Deep Learning Method (RN) image from https://www.freeimages.com

(b) WtL-seg

Evaluation Binary WtL





(a) Deep Learning Method (RN)

(b) WtL-seg



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Conclusion

• Excellent object contour maps full of details



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- Can be used for other object classes





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- Excellent object contour maps full of details
- Can be used for other object classes
- Closed shapes, but on a limited number of images
- Excellent segmentations: not blobby like, very high IoU and fine details
- Contour tracing is a promising application for CNNs

Thank you for listening!

