



Machine Learning Patterns of Life

Proof of Concept

4th ABM Workshop

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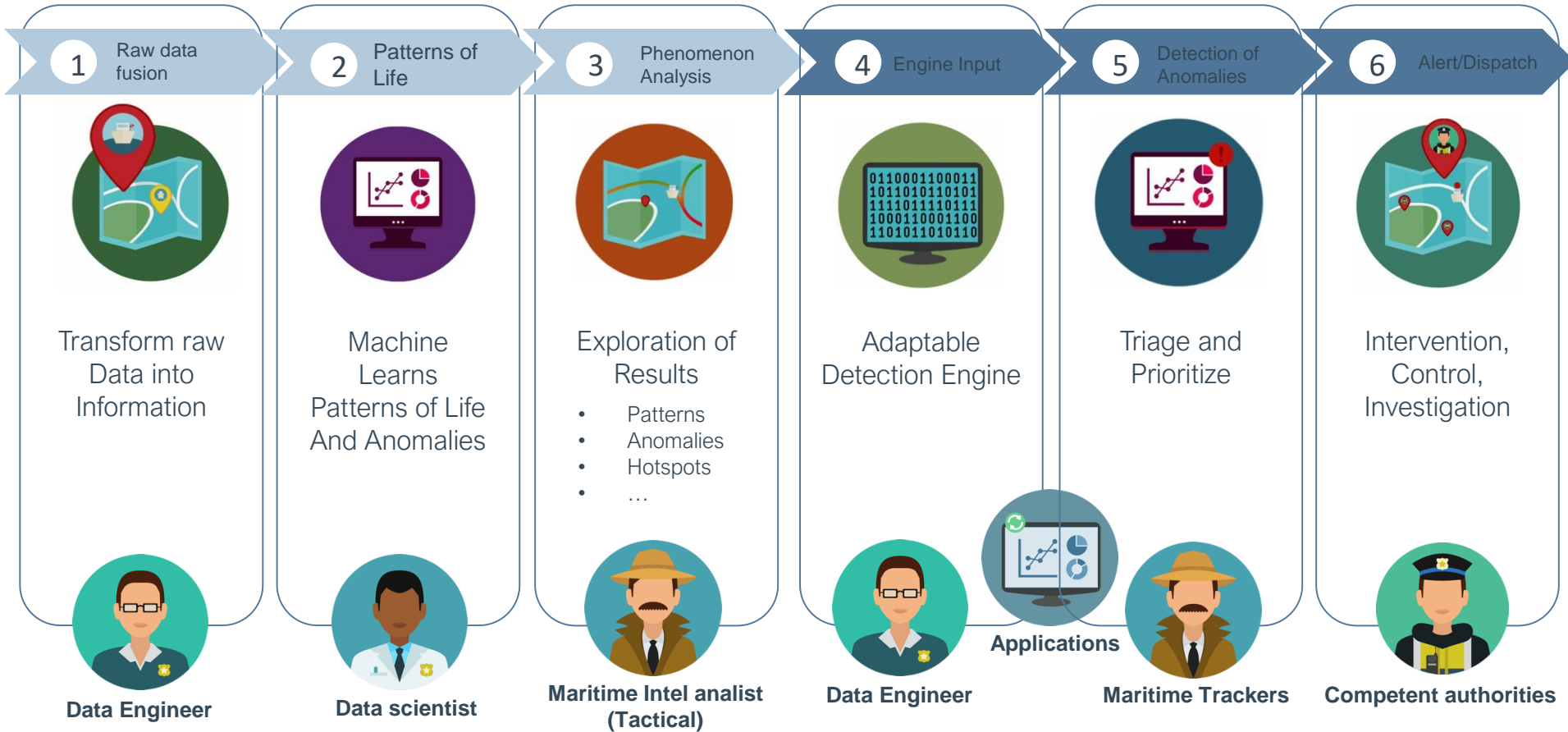
05/12/2018

Funded under the EMSA-Frontex SLA, the objective of this Proof of Concept is to better understand the patterns of life of vessels at sea and to validate the potential of Machine Learning on historical data to:

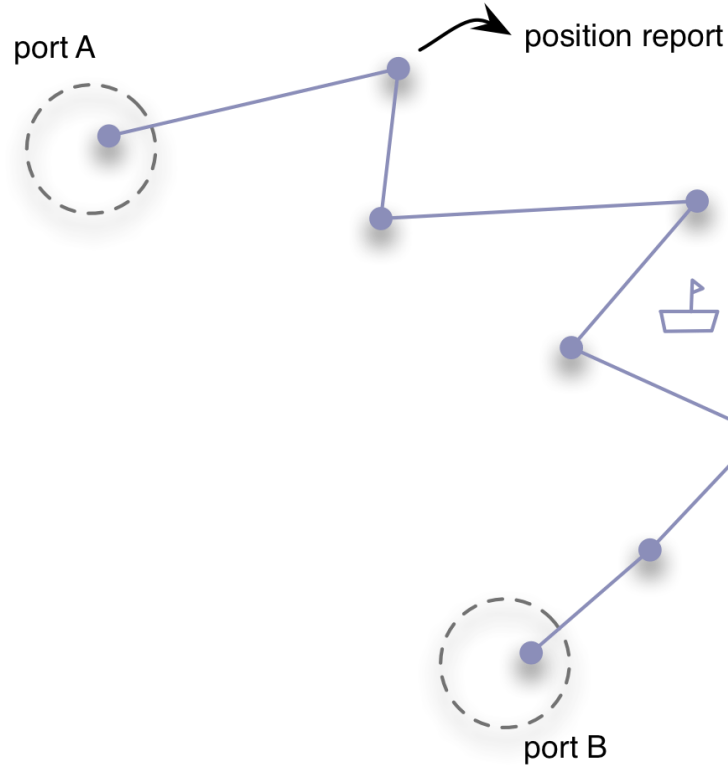
1. Decrease investigation time and increase awareness of potential cross-border criminality
2. Decrease investigation time and increase detections of suspicious drifting/stopping/anchoring
3. Decrease investigation time and increase detections of suspicious RDVs and transboarding

Machine Learning: Approach

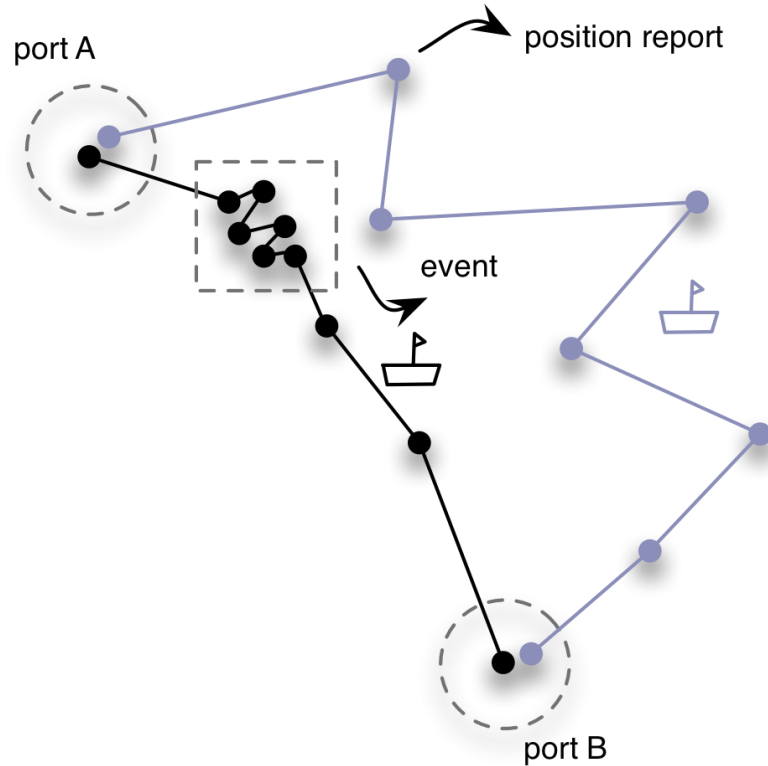
PRO-ACTIVE ALERTING / Operationalize Machine Learning



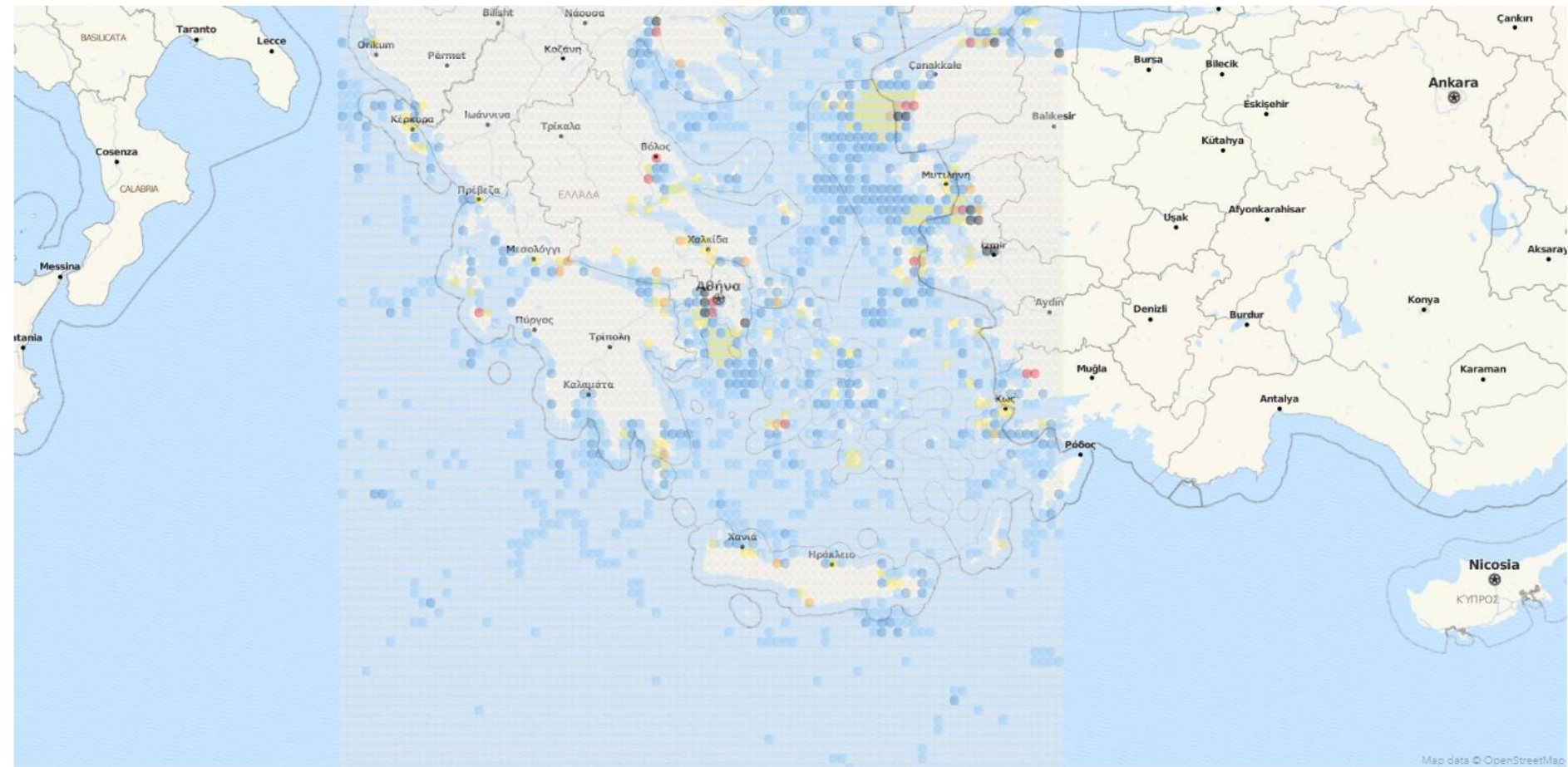
Machine Learning: Level of Detection



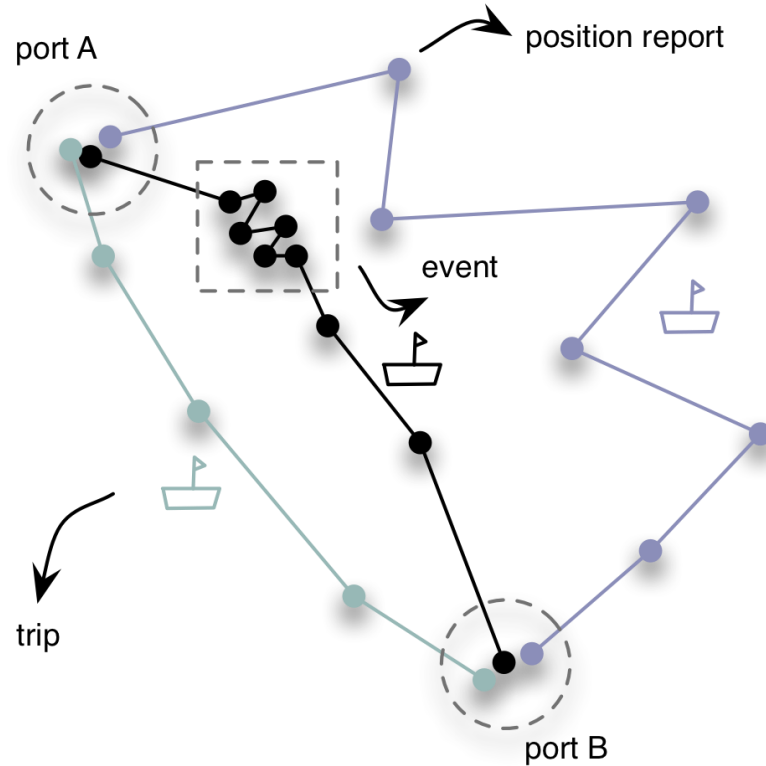
Machine Learning: Level of Detection



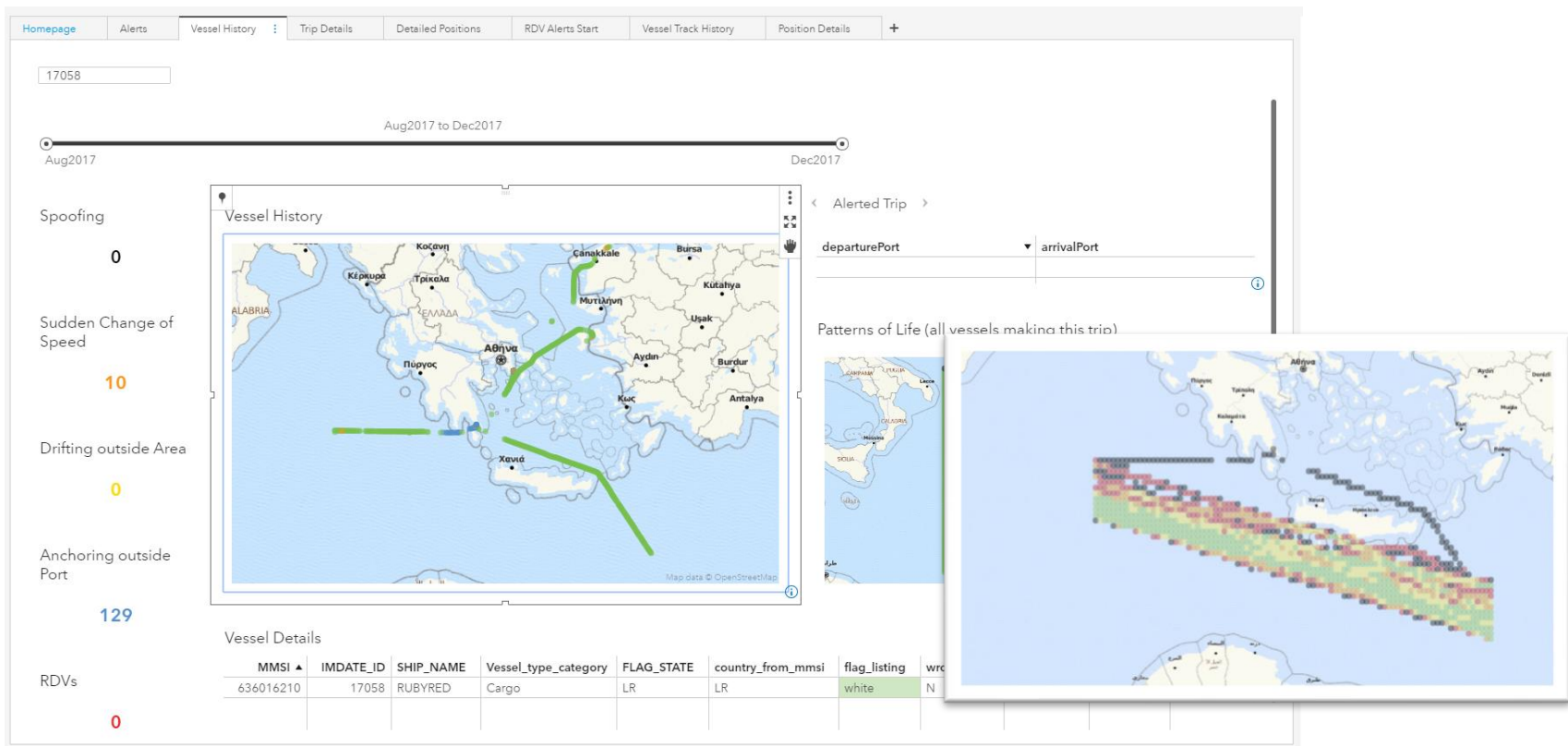
Machine Learning: Finding the relevant event



Machine Learning: Level of Detection



Machine Learning: Mapping trends



Machine Learning: Example of an Anomaly



Machine Learning: Example of an Anomaly



Machine Learning: Anomaly display

Homepage	Alerts	Abnormal Trip	All Trips	Detailed Positions	+
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Double-click an alert to investigate

IMDATE ID	Vessel Type	TripID	avgRank	Departure Time	Departure Port	Arrival Time
951319	Cargo	832334	99.97	July 22, 2017 06:12:41 AM	GRDPA	July 22, 2017 07:00:5...
56952	Cargo	360448	99.90	October 20, 2017 11:37:47 AM	GRVOL	October 20, 2017 07:...
139010	Fishing	541623	99.89	March 6, 2018 08:49:01 AM	GRAGG	March 17, 2018 07:41...
9345	Cargo	56894	99.86	February 23, 2018 11:34:30 AM	GRPER	February 23, 2018 12...
131687	Fishing	528532	99.85	August 9, 2017 09:08:28 PM	GRKIM	August 18, 2017 05:1...
9345	Cargo	56904	99.84	March 4, 2018 04:14:22 AM	GRDPA	March 4, 2018 04:17:...
9345	Cargo	56898	99.82	February 23, 2018 01:05:20 PM	GRDPA	February 23, 2018 01...
24242	Cargo	176787	99.78	March 9, 2018 02:45:35 PM	GRDPA	March 9, 2018 03:13:...
9345	Cargo	56886	99.78	February 5, 2018 04:33:53 AM	GRPAA	February 5, 2018 03:2...
894864	Cargo	822141	99.76	January 16, 2018 06:24:50 PM	GRHER	January 23, 2018 11:...
9345	Cargo	56900	99.75	February 26, 2018 08:10:30 AM	GRPER	February 26, 2018 09...
24242	Cargo	176164	99.73	August 3, 2017 02:58:19 PM	GRDPA	August 3, 2017 03:16...
4694	Cargo	13524	99.71	February 11, 2018 06:05:33 AM	OutofBox_E3	February 18, 2018 08...
9345	Cargo	56972	99.70	March 28, 2018 11:43:30 AM	GRPAA	March 29, 2018 06:35...
56952	Cargo	360946	99.70	April 11, 2018 05:13:55 AM	GRVOL	April 11, 2018 06:03:...
164548	Fishing	565861	99.69	August 18, 2017 09:17:45 AM	GRELt	August 18, 2017 05:0...
450831	Cargo	711290	99.68	January 13, 2018 03:07:25 PM	GRLAV	January 13, 2018 03:...
4731	Cargo	13818	99.67	November 25, 2017 09:38:37 AM	GRANA	November 30, 2017 0...
225939	Fishing	604857	99.66	September 26, 2017 10:17:25 AM	GRORO	September 26, 2017 0...
450831	Cargo	711326	99.66	March 3, 2018 06:51:18 AM	GRLAV	March 3, 2018 07:11:...
39969	Cargo	256383	99.65	August 31, 2017 04:56:21 AM	GRJKH	August 31, 2017 08:2...
951319	Cargo	832332	99.64	July 22, 2017 02:34:41 AM	GRLAV	July 22, 2017 05:48:3...
6685	Cargo	33786	99.62	December 20, 2017 03:41:17 PM	GRKTS	December 24, 2017 0...
103566	Fishing	475415	99.60	April 5, 2018 08:00:01 AM	GRKIM	April 5, 2018 06:56:4...
39969	Cargo	256360	99.59	August 3, 2017 07:28:24 AM	GRJKH	August 3, 2017 07:57...
24271	Cargo	176995	99.58	December 26, 2017 10:33:32 PM	OutofBox_W6	December 26, 2017 1...
45817	Cargo	289630	99.56	March 28, 2018 11:55:42 PM	OutofBox_W5	April 1, 2018 01:59:4...
24242	Cargo	176815	99.56	March 17, 2018 07:08:54 PM	GRDPA	March 18, 2018 03:41...
5700	Cargo	23374	99.56	November 3, 2017 02:29:57 PM	GRNKV	November 3, 2017 04...

Vessel Type Filter

- ☐ (missing values)
- ☒ Cargo
- ☒ Fishing
- ☐ Livestock
- ☐ Military/Govern...
- ☐ No vessel type in...
- ☐ Other
- ☐ Passenger
- ☐ Pleasure
- ☐ Tanker

Flag Listing Filter (Paris MoU)

- ☐ black
- ☐ empty
- ☐ grey
- ☐ white

Number of vessels that triggered an alert for the selection

1,058

Machine Learning: Anomaly display

Alert Dashboard

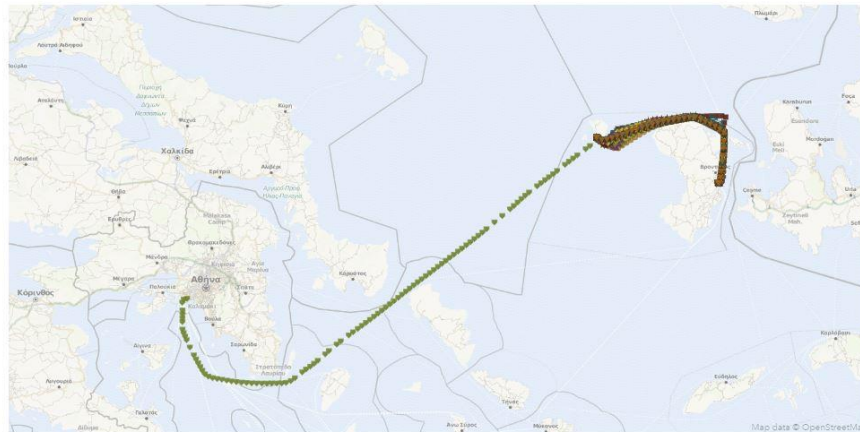
Homepage Alerts Abnormal Trip All Trips Detailed Positions +

9345

Trips taken by this Vessel

Departure Port	Arrival Port	Nbr of Trips	Avg Trip Distance	Avg Trip Speed
GRJXH	GRPAA	209	46.87	10.20
GRPAA	GRJXH	207	47.26	10.42
GRPAA	GRPAA	39	49.39	9.29
GRJXH	GRJXH	7	30.77	5.96
GRPER	GRDPA	2	3.75	3.56
GRDPA	GRPAA	1	144.95	10.34
GRDPA	GRPER	1	3.75	3.61
GRPAA	GRPER	1	143.63	11.38

Map of all Trips



Trip Details

TripID	Departure Port	Departure Time	Arrival Port	Arrival Time	maxtripSpeed	mintripSpeed	Avg Trip Distance	Avg Trip Speed	NormalRoute	NormalExtraRoute	NormalIntraRoute	nrAnchorage	nrDrifting	nrRDVs
56876	GRJXH	January 31, 2018 12:58:10 PM	GRPAA	January 31, 2018 04:48:01 PM	12.10	0.03	47.76	10.55	0.45	0.84	0.80	0	0	0
56880	GRJXH	February 1, 2018 12:57:31 PM	GRPAA	February 1, 2018 05:04:57 PM	11.99	0.05	48.69	9.99	0.40	0.89	0.85	0	0	0
56884	GRJXH	February 5, 2018 12:11:59 AM	GRPAA	February 5, 2018 04:09:01 AM	11.48	0.01	44.29	9.68	0.14	0.95	0.90	0	0	0
56904	GRDPA	March 4, 2018 04:14:22 AM	GRPAA	March 4, 2018 04:17:32 PM	11.52	0.02	144.95	10.34	1.00	0.90	0.04	0	0	0
56908	GRJXH	March 5, 2018 01:07:12 PM	GRPAA	March 5, 2018 04:55:01 PM	12.43	0.14	48.05	10.79	0.45	0.84	0.80	0	0	0
56912	GRJXH	March 6, 2018 01:12:29 PM	GRPAA	March 6, 2018 05:09:32 PM	12.30	0.15	48.18	10.28	0.40	0.84	0.79	0	0	0
56916	GRJXH	March 7, 2018 01:01:31 PM	GRPAA	March 7, 2018 04:45:52 PM	12.19	0.74	47.67	10.72	0.45	0.82	0.78	0	0	0



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European Maritime Safety Agency