AIGAD: AI for GNN-based Anomaly Detection



Any IoT sensor, blockchain-enabled



19 May 2022

AirTrace®

Any IoT sensor, blockchain-enabled

(Learn more at https://airtrace.io)



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Why anomaly detection in **Blockchain-IoT domains?**

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ADOSTM

Supporting Artificial Intelligence in IoT for early anomaly detection, timely alerting, and data-quality scoring, before injecting into the Blockchain





Our models include

- Prescriptive maintenance, by continuous monitoring and analysis for optimal use
- Anomaly detection for early decision making
- Data quality scoring for auditing and certification

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Ontological Resolution Middleware (Web of Things – Things Descriptor)

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Q-ARM 1b Air-Quality sensor	KEY	VALUE	ACTION
Categories	mode	outdoor	Delete
Available Selected Air quality sensor Air quality sensor	nsor types	02.C0.N0x.S02	Delete
Thermometer	magnitude	gas	Delete
Sensor photo (optional) Change Remove	x		
Eight intensity sensor			Discard
Light intensity sensor			Discard

Name	Description	Domain	New/MyUpdated/ MyReused/Reused	Language
AOM (ADOS Ontology Model)	Regulates data for anomaly detection models to work properly (e.g. model version, TEE needed, etc.)	Deep Learning model specification	New	WoT
SSN	Sensors and their observations, the involved procedures, and the observed properties.	Systems (sensors and actuators)	Reused	WoT
WGS84	Represents geocoordinates (latitude and longitude), with class geo:point and properties geo:latitude, geo:longitude, geo:altitude.	Geolocation (outdoors)	Reused	WoT
DUL	By combining WSG84 properties with dul:hasLocation from DUL ontology we can represent the sensor location indoors	Geolocation (indoors)	Reused	WoT
FIEMSER	Represents the way to communicate with the IoT devices, including, at least, communication protocol and its version.	Communications	Reused	WoT
QUDT	Represents a comprehensive list of quantities, units and dimensions to define IoT readings formats.	Observations	Reused	WoT
FOAF	Information about IoT vendor and version of the device	Vendor, version and deployment time	Reused	WoT

Infrastructure



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Challenge (REACH-2021_THEMEDRIVEN-CERR_7.1)

/ Data Providers / Idea75

:de-75	ADDatasets O Activity Stream O About			
	Search datasets Q			
dea75 dea75 is a SME that aims at providing innovative solutions for process	4 datasets found Order by: Relevance			
optimization and energy efficiency of industrial plants following the new guideline of Industry 4.0 and read more	Active Power First column name of Device Second column Recorded electrical parameter Third column timestamp Forst rodumn value of parameter			
Followers Datasets	Current Frist column name of Device Second column. Recorded electrical parameter Third column timestamp Fourth column value of parameter			
Data Providers	GSV			
dea75 (4)	Active Energy First column: name of Device Second column: Recorded electrical parameter Third column: timestamp			
T Categories	Fourth column: value of parameter			
Manufacturing/Industry (4)				
• T	Voltage			
t laga	First column: name of Device Second column: Recorded electrical parameter Third column: timestamp			
REACH-2021-READYMAD (4)				
REACH-2021-READYMAD				

	Dispositivo, Parametro, Data, Valore
•	o745f63896fb7909fdd347b4f731co74o0732160-3769b5b8ooxdoc9f13547dc69946d4520216bsf40377d4660c0dcf073o97f38167abcobedb88183894bsfb. Potenza attiva totale;16:30:04 12/10/2020, "12,8900"
5	e745f62896fb7909fdd347b4f721ce24e0222160a3769b5b8eeadacc9f13547dc69946d4630316baf40277d4660c0dcf073e92f38162abceb9db88193894b8fb, otenza attiva totale,16:31:04 12/10/2020, "12,9700"
	otenza attiva totale,16:32:03 12/10/2020,"13,4400"
5	e745f62896fb7909fdd347b4f721ce24e0222160a3769b5b8eeadacc9f13547dc69946d4630316baf40277d4660c0dcf073e92f38162abceb9db88193894b8fb,Potenza attiva totale,16:33:03 12/10/2020, "13,2100"
5	e745f62896fb7909fdd347b4f721ce24e0222160a3769b5b8eeadacc9f13547dc69946d4630316baf40277d4660c0dcf073e92f38162abceb9db88193894b8fb,Potenza attiva totale,16:34:04 12/10/2020, "13,2400"
	e745f62896fb7909fdd347b4f721ce24e0222160a3769b5b8eeadacc9f13547dc69946d4630316baf40277d4660c0dcf073e92f38162abceb9db88193894b8fb,Potenza attiva totale,16:35:04 12/10/2020, "13,3200"
3	e745f62896fb7909fdd347b4f721ce24e0222160a3769b5b8eeadacc9f13547dc69946d4630316baf40277d4660c0dcf073e92f38162abceb9db88193894b8fb,Potenza attiva totale,16:36:03 12/10/2020, "13,1000"
,	e745f62896fb7909fdd347b4f721ce24e0222160a3769b5b8eeadacc9f13547dc69946d4630316baf40277d4660c0dcf073e92f38162abceb9db88193894b8fb,Potenza attiva totale,16:37:03 12/10/2020, "13,2100"
0	e745f62896fb7909fdd347b4f721ce24e0222160a3769b5b8eeadacc9f13547dc69946d4630316baf40277d4660c0dcf073e92f38162abceb9db88193894b8fb,Potenza attiva totale,16:38:04 12/10/2020, "12,8800"
1	e745f62896fb7909fdd347b4f721ce24e0222160a3769b5b8eeadacc9f13547dc69946d4630316baf40277d4660c0dcf073e92f38162abceb9db88193894b8fb, Potenza attiva totale,16:39:04 12/10/2020, "13,2000"
2	e745f62896fb7909fdd347b4f721ce24e0222160a3769b5b8eeadacc9f13547dc69946d4630316baf40277d4660c0dcf073e92f38162abceb9db88193894b8fb,Potenza attiva totale,16:40:04 12/10/2020, "13,0700"
3	e745f62896fb7909fdd347b4f721ce24e0222160a3769b5b8eeadacc9f13547dc69946d4630316baf40277d4660c0dcf073e92f38162abceb9db88193894b8fb, Potenza attiva totale,16:41:03 12/10/2020, "13,1700"
4	e745f62896fb7909fdd347b4f721ce24e0222160a3769b5b8eeadacc9f13547dc69946d4630316baf40277d4660c0dcf073e92f38162abceb9db88193894b8fb, Potenza attiva totale,16:42:04 12/10/2020, "13,3100"
5	e745f62896fb7909fdd347b4f721ce24e0222160a3769b5b8eeadacc9f13547dc69946d4630316baf40277d4660c0dcf073e92f38162abceb9db88193894b8fb, Potenza attiva totale,16:43:04 12/10/2020, "13,3100"
6	e745f62896fb7909fdd347b4f721ce24e0222160a3769b5b8eeadacc9f13547dc69946d4630316baf40277d4660c0dcf073e92f38162abceb9db88193894b8fb, Potenza attiva totale,16:44:04 12/10/2020, "13,2800"
7	e745f62896fb7909fdd347b4f721ce24e0222160a3769b5b8eeadacc9f13547dc69946d4630316baf40277d4660c0dcf073e92f38162abceb9db88193894b8fb,Potenza attiva totale,16:45:03 12/10/2020,"12,8100"
8	e745f62896fb7909fdd347b4f721ce24e0222160a3769b5b8eeadacc9f13547dc69946d4630316baf40277d4660c0dcf073e92f38162abceb9db88193894b8fb,Potenza attiva totale,16:46:09 12/10/2020,"12,9800"
9	e745f62896fb7909fdd347b4f721ce24e0222160a3769b5b8eeadacc9f13547dc69946d4630316baf40277d4660c0dcf073e92f38162abceb9db88193894b8fb, Potenza attiva totale, 16:47:04 12/10/2020, "12,9500"
0	e745f62896fb7909fdd347b4f721ce24e0222160a3769b5b8eeadacc9f13547dc69946d4630316baf40277d4660c0dcf073e92f38162abceb9db88193894b8fb,Potenza attiva totale,16:48:04 12/10/2020,"13,4300"
1	e745f62896fb7909fdd347b4f721ce24e0222160a3769b5b8eeadacc9f13547dc69946d4630316baf40277d4660c0dcf073e92f38162abceb9db88193894b8fb,Potenza attiva totale,16:49:03 12/10/2020,"13,1900"
2	e745f62896fb7909fdd347b4f721ce24e0222160a3769b5b8eeadacc9f13547dc69946d4630316baf40277d4660c0dcf073e92f38162abceb9db88193894b8fb,Potenza attiva totale,16:50:04 12/10/2020,"13,2800"
3	e745f62896fb7909fdd347b4f721ce24e0222160a3769b5b8eeadacc9f13547dc69946d4630316baf40277d4660c0dcf073e92f38162abceb9db88193894b8fb, Potenza attiva totale, 16:51:09 12/10/2020, *13,3500*
4	e745f62896fb7909fdd347b4f721ce24e0222160a3769b5b8eeadacc9f13547dc69946d4630316baf40277d4660c0dcf073e92f38162abceb9db88193894b8fb,Potenza attiva totale,16:52:03 12/10/2020,"13,0600"
5	e745f62896fb7909fdd347b4f721ce24e0222160a3769b5b8eeadacc9f13547dc69946d4630316baf40277d4660c0dcf073e92f38162abceb9db88193894b8fb,Potenza attiva totale,16:53:03 12/10/2020,"13,2400"
6	e745f62896fb7909fdd347b4f721ce24e0222160a3769b5b8eeadacc9f13547dc69946d4630316baf40277d4660c0dcf073e92f38162abceb9db88193894b8fb,Potenza attiva totale,16:54:04 12/10/2020,"13,1200"
7	e745f62896fb7909fdd347b4f721ce24e0222160a3769b5b8eeadacc9f13547dc69946d4630316baf40277d4660c0dcf073e92f38162abceb9db88193894b8fb,Potenza attiva totale,16:55:04 12/10/2020,"13,2900"
8	e745f62896fb7909fdd347b4f721ce24e0222160a3769b5b8eeadacc9f13547dc69946d4630316baf40277d4660c0dcf073e92f38162abceb9db88193894b8fb, Potenza attiva totale, 16:56:04 12/10/2020, "13,3000"
9	e745f62896fb7909fdd347b4f721ce24e0222160a3769b5b8eeadacc9f13547dc69946d4630316baf40277d4660c0dcf073e92f38162abceb9db88193894b8fb, Potenza attiva totale, 16:57:03 12/10/2020, "13,1100"
0	e745f62896fb7909fdd347b4f721ce24e0222160a3769b5b8eeadacc9f13547dc69946d4630316baf40277d4660c0dcf073e92f38162abceb9db88193894b8fb, Potenza attiva totale, 16:58:04 12/10/2020, "12,8100"
1	e745f62896fb7909fdd347b4f721ce24e0222160a3769b5b8eeadacc9f13547dc69946d4630316baf40277d4660c0dcf073e92f38162abceb9db88193894b8fb, Potenza attiva totale, 16:59:04 12/10/2020, "13,0700"
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Embeddings and modelling



Own data Providers





Autoridad Portuaria de Cartagena



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Demo

(https://www.youtube.com/watch?v=DSYL4IWH81o)



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Conclusions

- Highly innovative approach for anomaly detection
- General use case defined
- Available UI already
- Experienced team



Thanks!

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AirTrace ADOS Technical Lead



Vavarro Ruiz