



“Sharing Knowledge Statistik Distribusi BPS RI Implementation Big Data-AIS”

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Background



Background



AIS Data



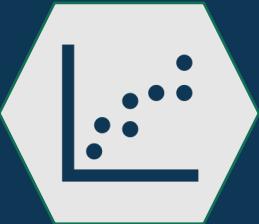
Sumber: MarineTraffic

Gambar 1. Tangkapan layar lalu lintas kapal berdasarkan data AIS

Background

Potential of AIS: nowcasting

- *real-time*
- Indonesia is a maritime and archipelagic region



Modes of Transportasi	Export Volume (thousand tons)	Import Volume (thousand tons)
Air	160,2	1.132,6
Sea	647.240,3	161.494,8
Land	276,3	1,4
Total	654.474,4	162.628,7

Source: BPS



Objective



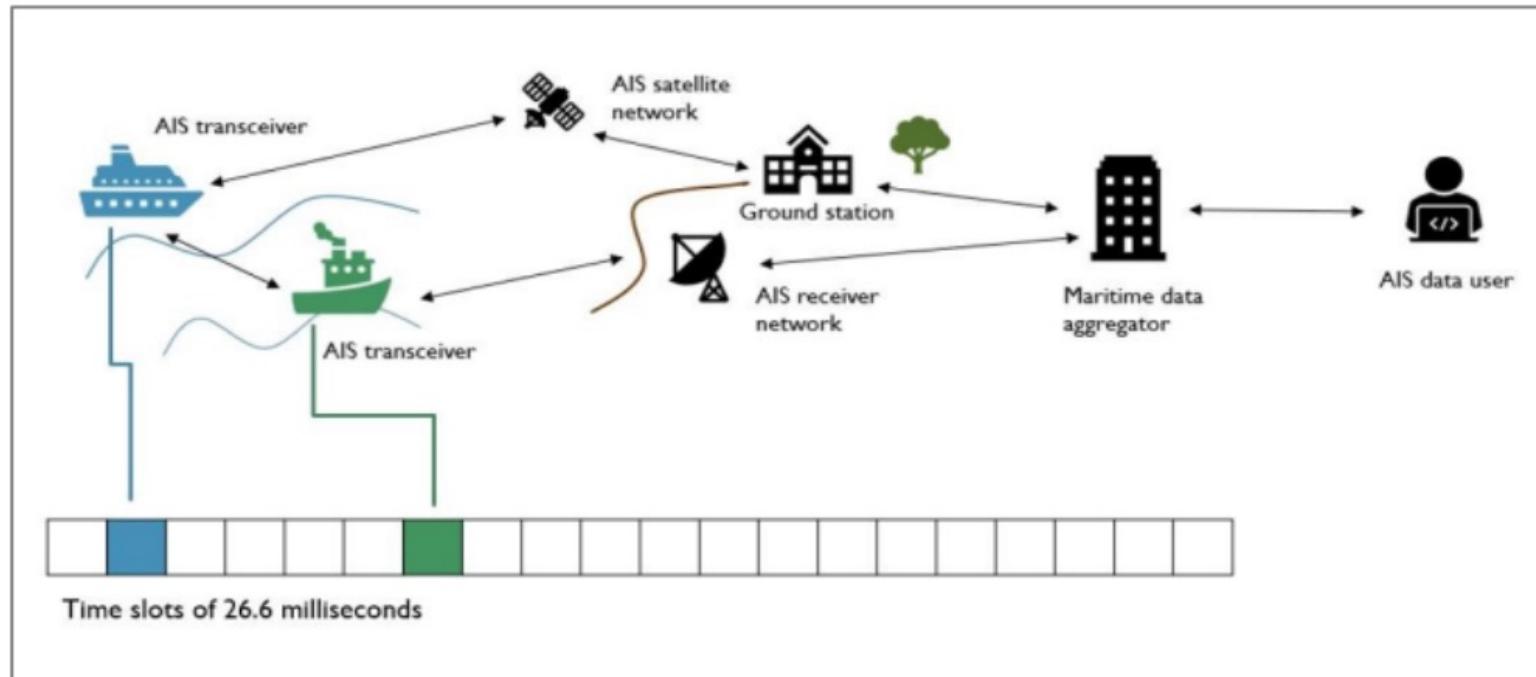
Objective

Explore the use of AIS data to support or develop trade indicator

Formulate the formation of composite indicators that can describe export-import statistics using clean AIS attribute data

Forecasting Export and Import values using AIS Data

Methodology



Sumber: UNSD

Gambar 2. Alur pengiriman sinyal AIS dari kapal hingga ke pengguna data

Data Collection Method

Export import data: BPS website

- Value (dolar US) and volume (kg) export import
- Monthly period

AIS data: exactEarth via Platform Global UN

- Indonesian Bounding box and 123 ports
- December 2018-2020
- 35 features (statis dynamic), 661.8 million record

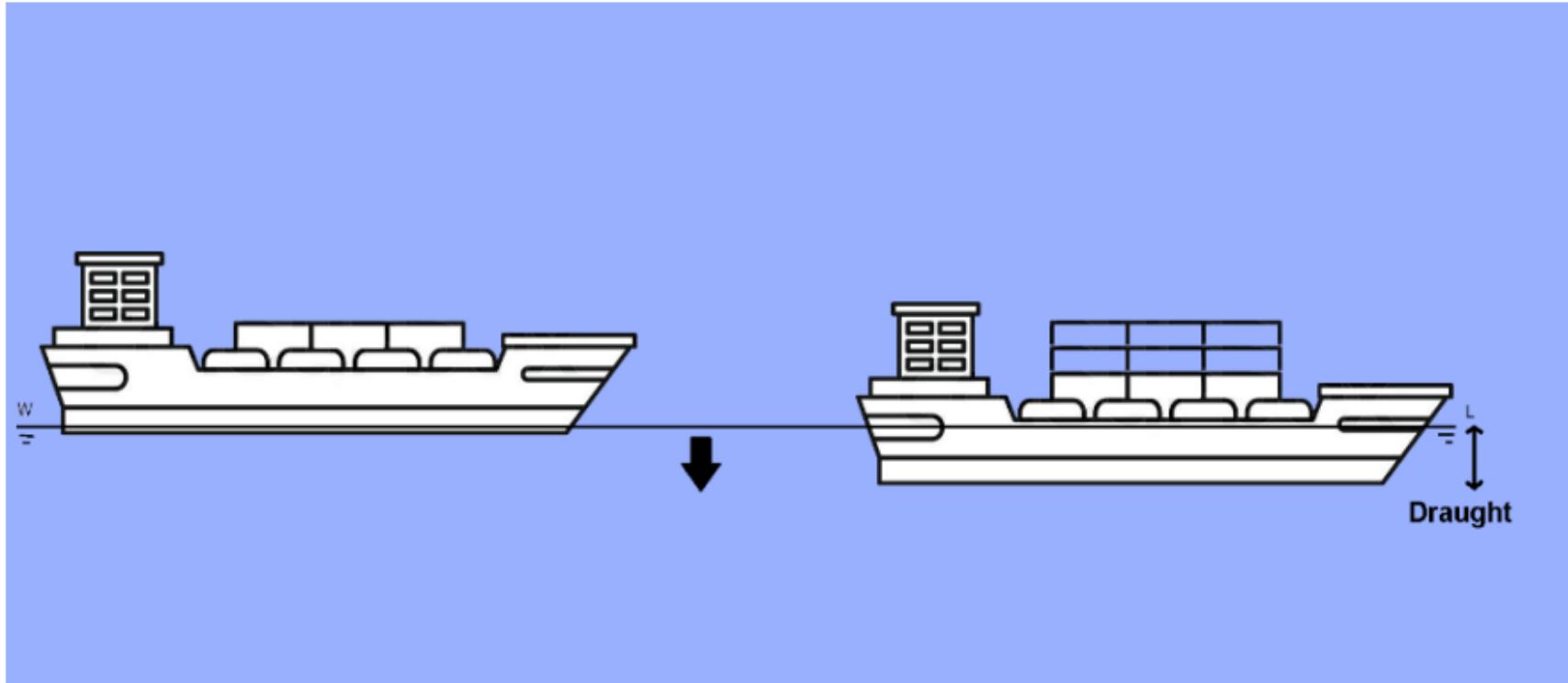
The screenshot shows a laptop screen displaying the official website of the Indonesian Central Bureau of Statistics (BPS). The URL <https://bps.go.id/exim> is visible in the browser's address bar. The main content area is titled "EXPORT DAN IMPORT" and displays a table of monthly export and import data from January to November. The table includes columns for No., Bulan, Nilai Ekspor (US \$), Berat Ekspor (KG), Nilai Impor (US \$), and Berat Impor (KG). All values for January through November are listed as "belum rilis". A note at the bottom right of the table states: "Sehubungan dengan adanya perbaikan infrastruktur sistem di BPS maka". The left sidebar contains various navigation links such as "Beranda", "Tentang Kami", "Berita", "Senarai Rencana Terbit", "Publikasi", "Berita Resmi Statistik", "Layanan", and "PPID". There is also a "DATA SENSUS" section. The top right of the page includes language selection ("Indonesia | English") and a search bar.

No.	Bulan	Nilai Ekspor (US \$)	Berat Ekspor (KG)	Nilai Impor (US \$)	Berat Impor (KG)
1	Januari	15 293 665 753,16	52 587 516 521,05	13 329 901 020,00	13 078 332 805,00
2	Februari	belum rilis	belum rilis	belum rilis	belum rilis
3	Maret	belum rilis	belum rilis	belum rilis	belum rilis
4	April	belum rilis	belum rilis	belum rilis	belum rilis
5	Mei	belum rilis	belum rilis	belum rilis	belum rilis
6	Juni	belum rilis	belum rilis	belum rilis	belum rilis
7	Juli	belum rilis	belum rilis	belum rilis	belum rilis
8	Agustus	belum rilis	belum rilis	belum rilis	belum rilis
9	September	belum rilis	belum rilis	belum rilis	belum rilis
10	Oktober	belum rilis	belum rilis	belum rilis	belum rilis
11	November	belum rilis	belum rilis	belum rilis	belum rilis

Data Processing Methods (Features)

- Used features

<i>Nama Fitur</i>	<i>Keterangan</i>
MMSI	Ship unique number <i>Maritime Mobile Service Identity (MMSI)</i>
DTG	Observation date (yyyy-MM-dd'T'HH:mm:ssZ)
DRAUGHT	The vertical distance between the waterline and the bottom hull (meter)
LONGITUDE	Coordinate longitude in WGS 84 (decimal degree)
LATITUDE	Coordinate latitude in WGS 84 (decimal degree)

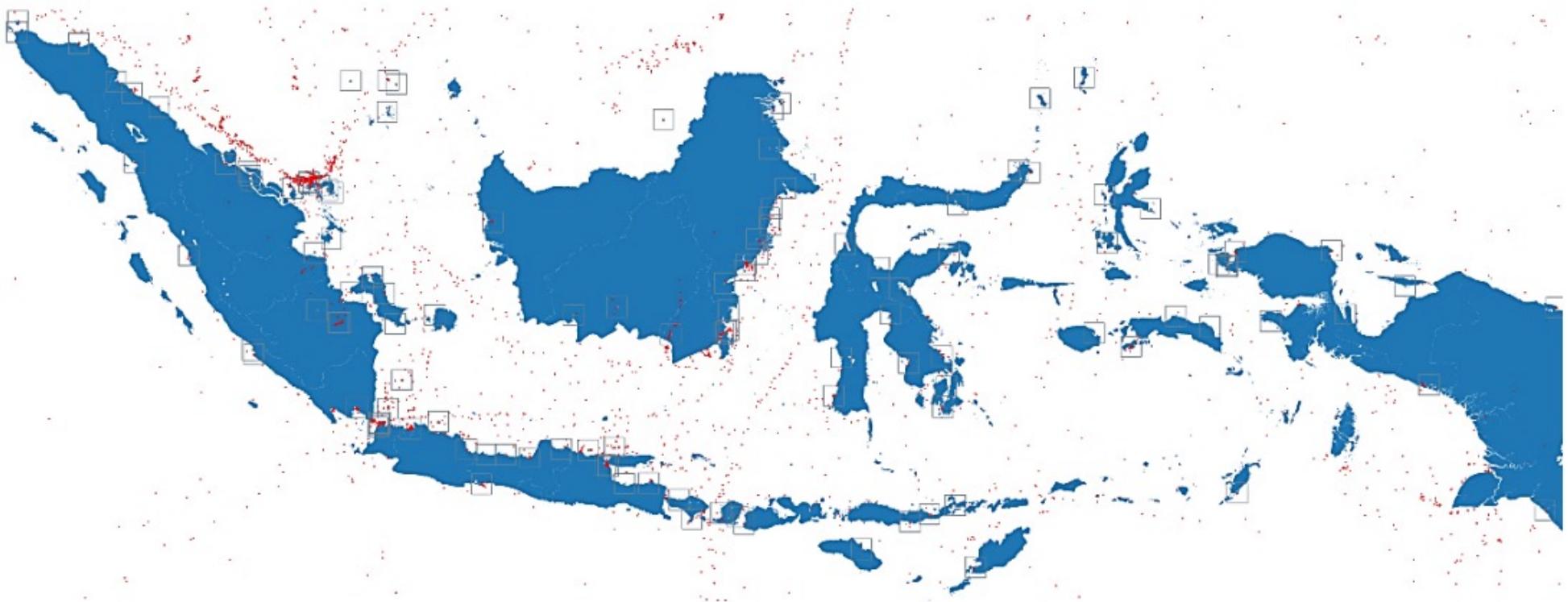


Data Processing Methods (Cleaning)

- Filtering AIS data

Filter 1	Valid vessel's MMSI	100000000 \leq MMSI \leq 999999999
Filter 2	Moving vessel	Selisih koordinat $>$ 0.1°
Filter 3	Navigation status of anchored vessels	At anchor Restricted manoeuvrability Moored
Filter 4	Non-zero draught	Draught $>$ 0
Filter 5	Relevant vessel type	Cargo Tanker
Filter 6	Vessels inside a port	Inside bounding box port

Bounding box



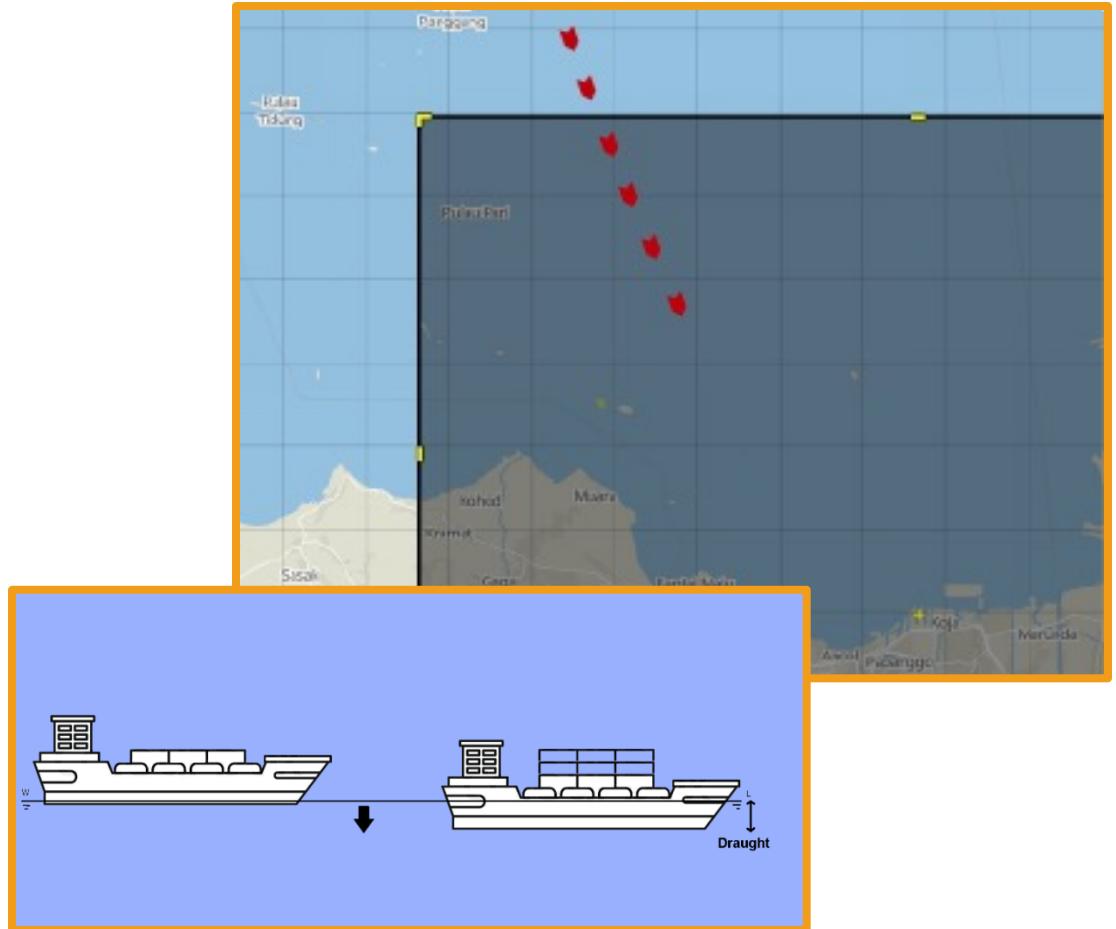
Keterangan: Peta hanya menampilkan wilayah Indonesia

Gambar 12. Pemetaan kapal dan *bounding box* pelabuhan Indonesia berdasarkan data AIS

Forming Indicators

- Monthly indicator AIS:

-  Length of time vessels in port (*timeInPort*)
-  Unique numbers of vessels in port (*numVessel*)
-  Numbers of vessel visits I (*numVisit*)
-  Numbers of changes in t apal (*numDraughtDiff*)
-  The amount of change in the ship's water draught (*sumDraughtDiff*)





Forecasting Method





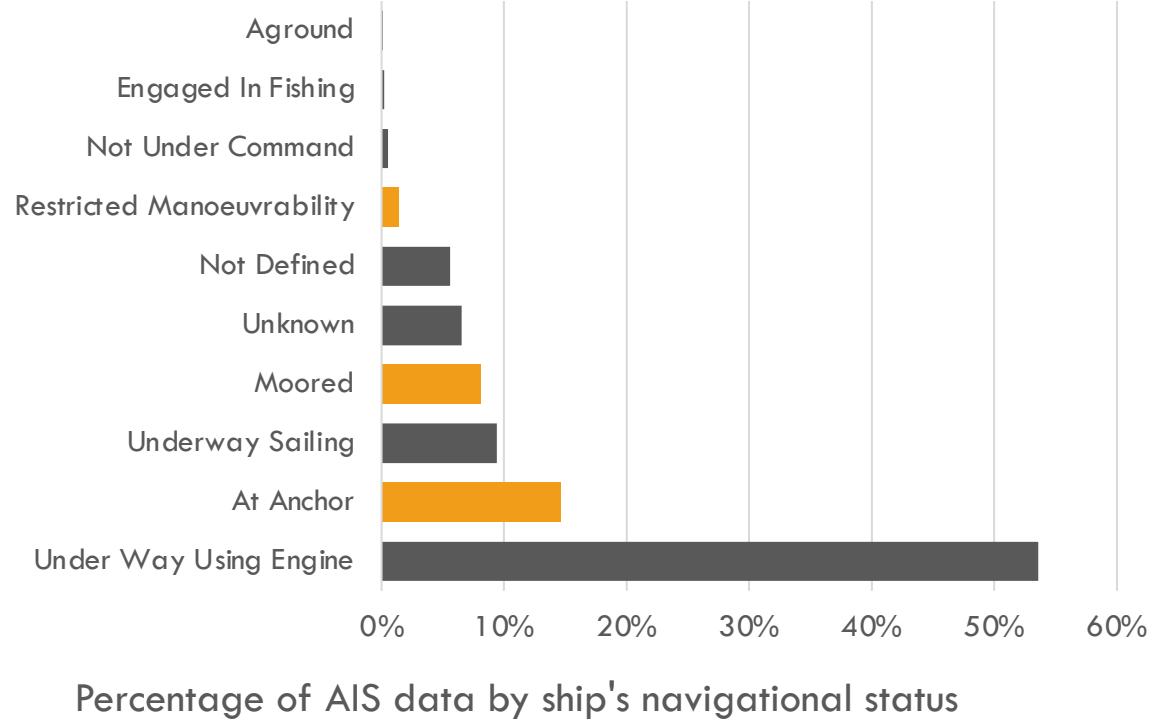
Results and Discussion

Preprocessing Data AIS

<i>Filter Stages</i>	<i>Total AIS Data</i>
Whole AIS Messages	661,847,517
Filter 1: valid vessel's MMSI	655,794,385
Filter 2: moving vessels	640,138,932
Filter 3: navigation status of anchored vessel	154,253,335
Filter 4: non-zero draught	145,645,162
Filter 5: relevant vessel type	98,837,324
Filter 6: vessels inside a port	73,576,052

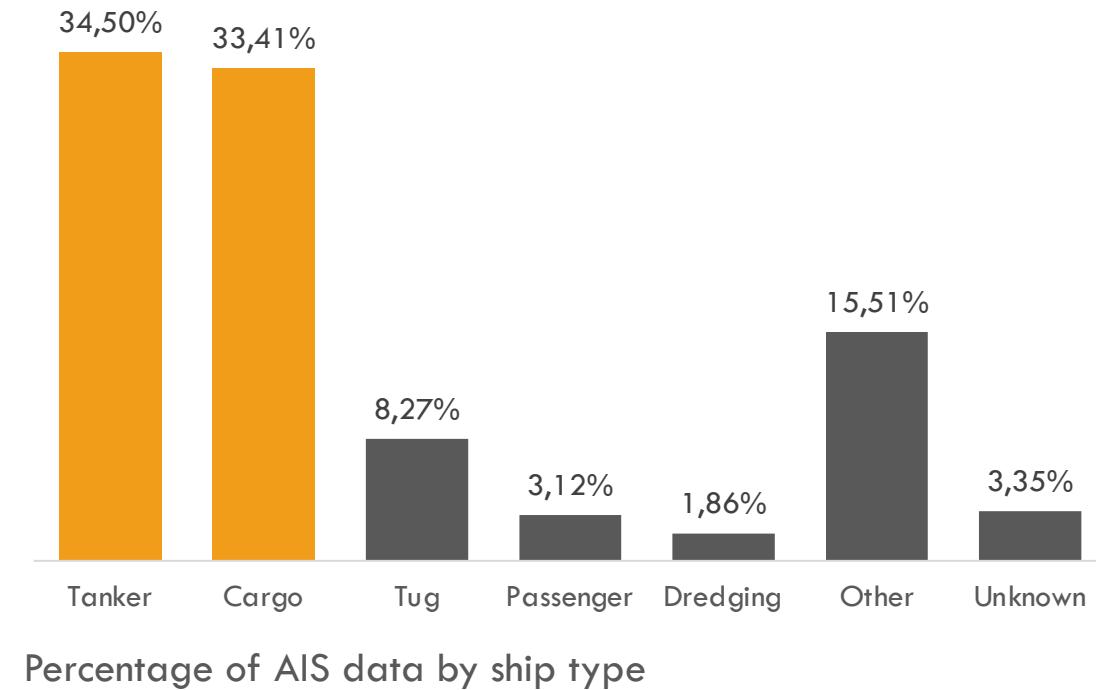
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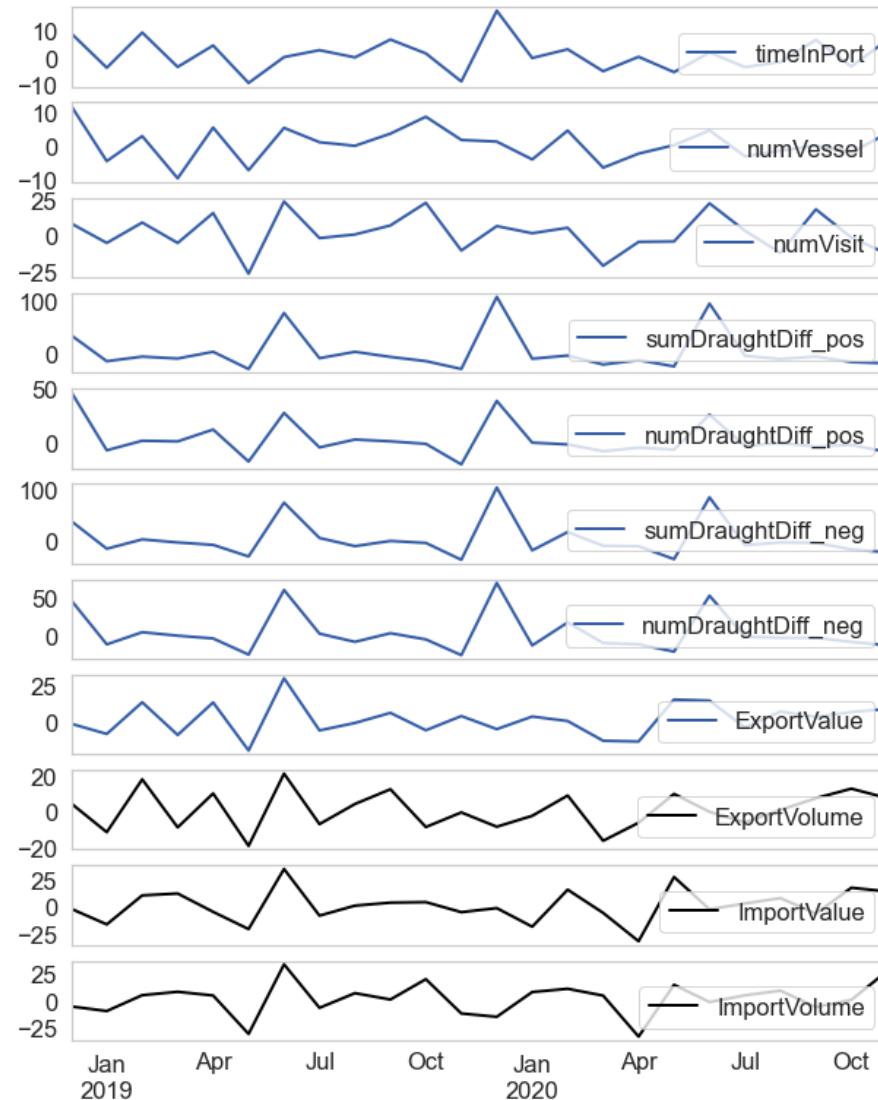


Preprocessing Data AIS

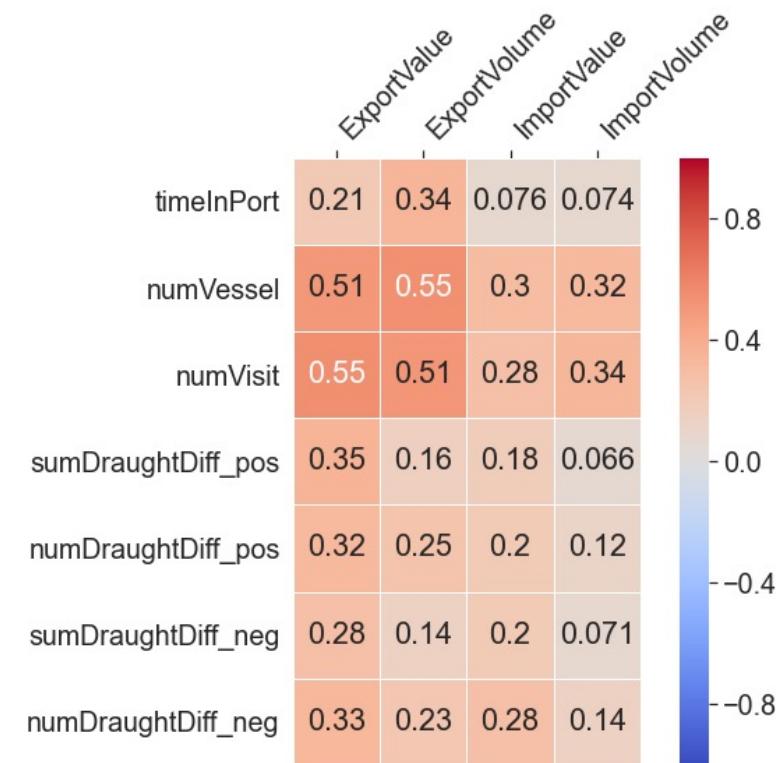
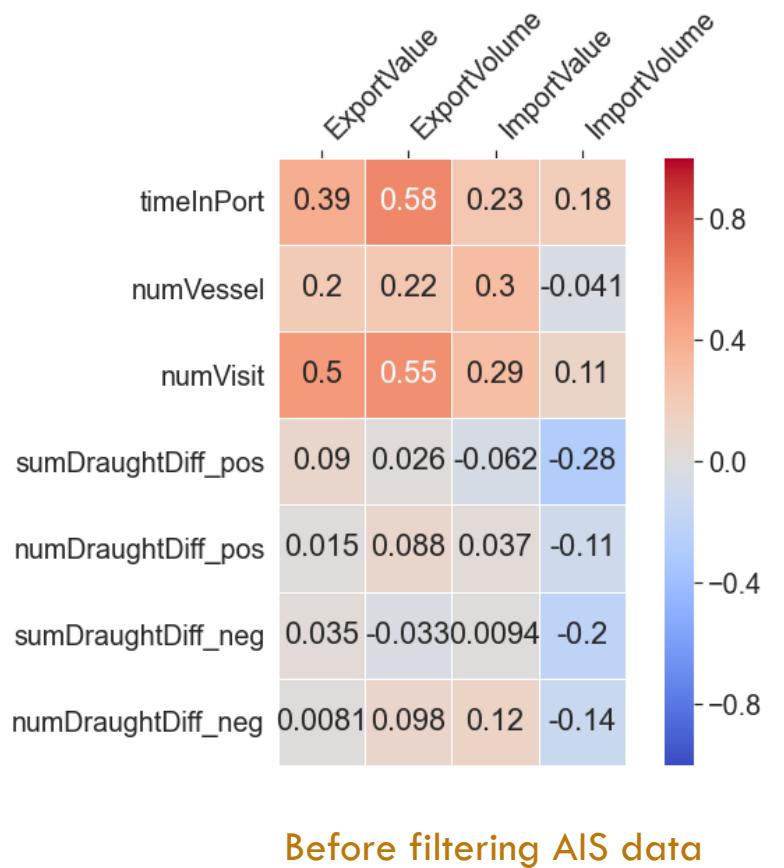
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Indicator Derived from AIS



Indicator Derived from AIS



Prediction Results

1 All
 2 Permutation
 3 Stepwise
 4 Significance
 5 Correlation

		ANN		ARIMA	
		Train	Test	Train	Test
Export Value	X1 ^a , X2 ^a , X3 ^a , X4, X6	0.1068 ^b	1.2118	0.3769	1.6388
	X2 ^a , X6 ^a	0.2934	0.9310	0.4905	1.4856
	X3^a	0.7223	0.7852^b	0.4569	1.2496 ^b
	X1 ^a , X2 ^a , X3 ^a	0.2020	1.3935	0.4334	1.4063
	X2, X3, X4, X6	0.4870	0.7950	0.3494 ^b	1.8891
Export Volume	X1, X2, X3 ^a , X4, X6	1.1913	1.4106	0.7685 ^b	1.8301
	X2, X3 ^a , X4, X6	1.1937	1.3347	0.9694	1.9395
	X2^a	1.3341	1.2974	1.1668	1.2391^b
	X3 ^a	1.3618	1.2938	0.9768	1.7833
	X1, X2, X3^a, X4	1.0408^b	1.2305^b	0.7886	1.8389

a. Significant predictor variables in ARIMA model

b. The smallest value for each response variable

Best Model Parameters

```
'hidden_layer': [75, 50, 100],  

'activation': 'leaky_relu',  

'learning_rate': 0.7348,  

'momentum': 0.5662
```

```
'hidden_layer': [60, 9, 69],  

'activation': 'leaky_relu',  

'learning_rate': 0.1513,  

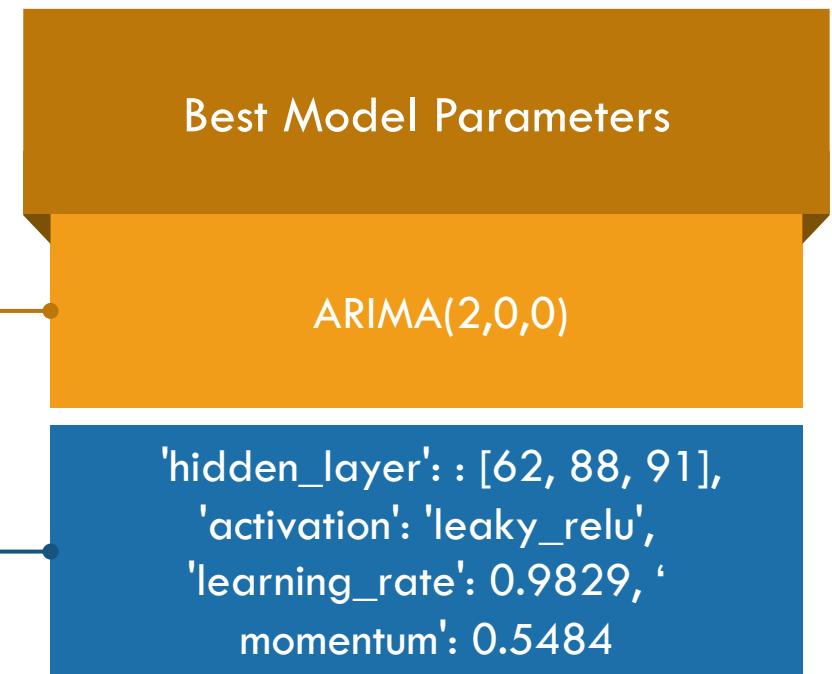
'momentum': 0.4370
```

Prediction Results

1 All
 2 Permutation
 3 Stepwise
 4 Significance
 5 Correlation

	ANN		ARIMA		
	Train	Test	Train	Test	
Import Value	X1 ^a , X2, X3 ^a , X5, X7	0.0055 ^b	1.0299 ^b	0.4112 ^b	1.0004
	X1, X2, X7	0.0685	1.2387	0.7100	0.9077
	X2	0.6839	1.4943	0.7173	0.9944
	X1 ^a , X3 ^a	0.3946	1.2611	0.5232	2.2097
	X2, X3^a, X5	0.3344	1.5844	0.5655	0.9061^b
Import Volume	X1, X2, X3 ^a , X5, X7	0.0323 ^b	1.4515	0.6563	1.7721
	X1	0.8067	0.7581^b	0.5663 ^b	1.6655
	X3 ^a	0.7839	1.2394	0.7072	1.4441 ^b
	X3 ^a	0.7697	1.1988	0.7072	1.4441 ^b
	X2, X3 ^a	0.6436	1.4102	0.6822	1.6684

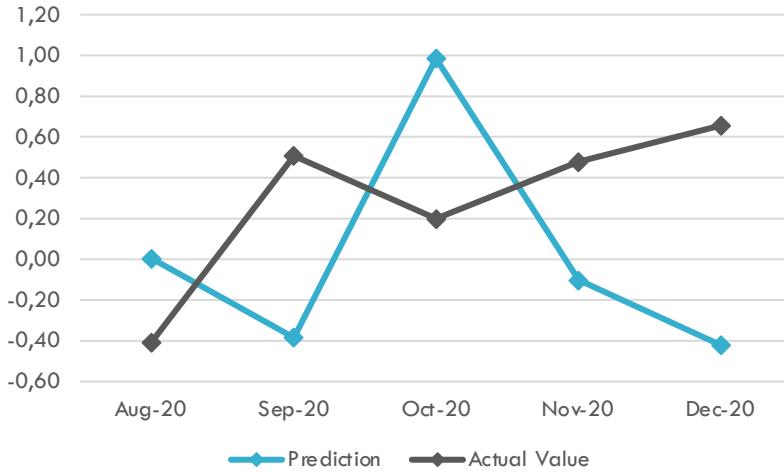
- a. Significant predictor variables in ARIMA model
 b. The smallest value for each response variable



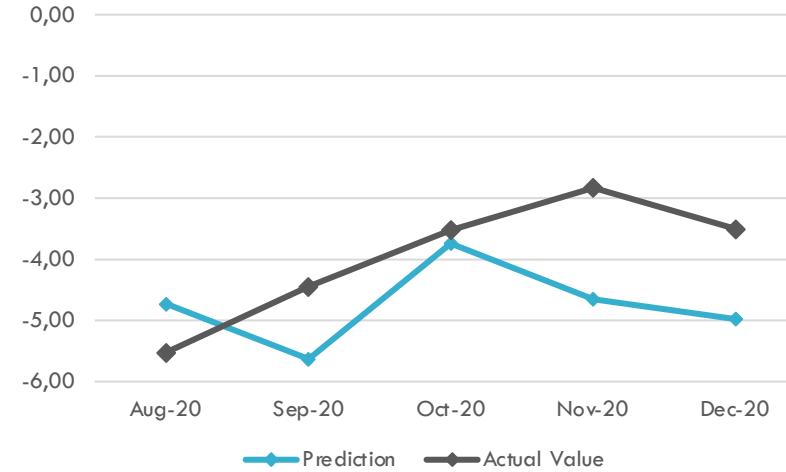


Prediction vs Actual

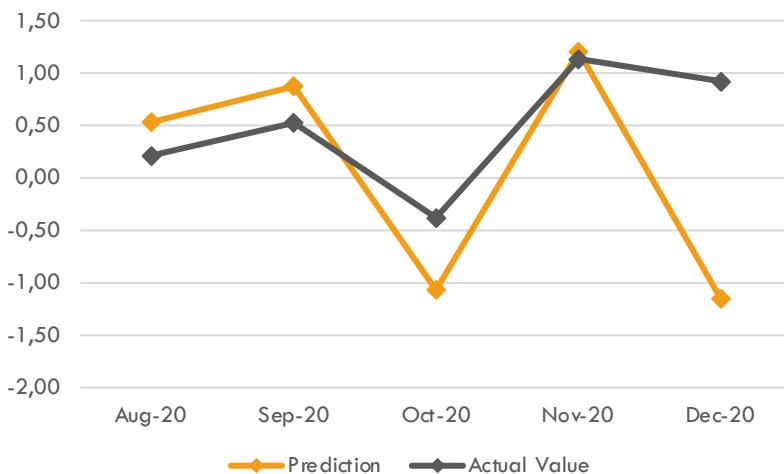
Export Value Prediction



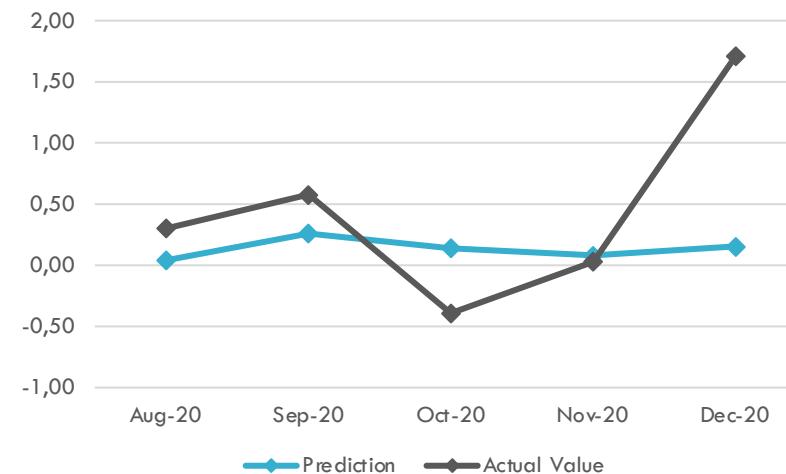
Export Volume Prediction



Import Value Prediction



Import Volume Prediction





Closing

Export-Import Value Nowcasting Procedure Using Big Data-AIS and Machine Learning Techniques

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Friday, 22 September 2022

THANK YOU

