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TITLE: REPOSITORY AND KNOWLEDGE BASE ON INFECTIOUS DISEASES FOR SEAFARERS

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- The DESSEV project, funded by the European Union Erasmus+, a DEcision Support System (DSS) addressing Epidemic threats on sea-going Vessels

- learning repository and knowledge base on infectious diseases.

- **www.dessevproject.eu**

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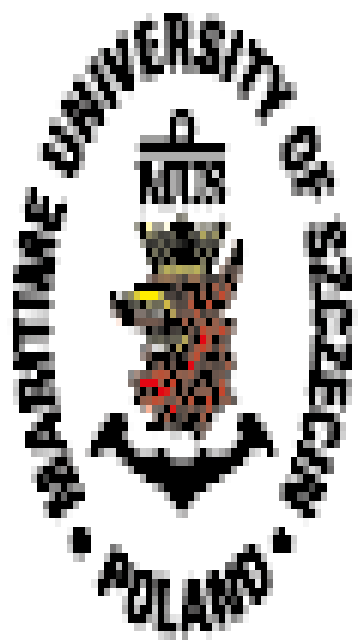

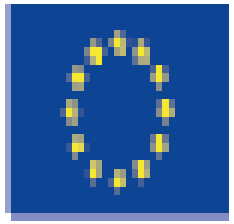

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- A second key objective of the project was the creation of a database on infectious diseases.
- This database comprises 22 infectious diseases described with 35 symptoms, grouped into 8 categories.
- The accumulate knowledge serves as the foundation for the development of IF...THEN... rules in the form of decision trees.

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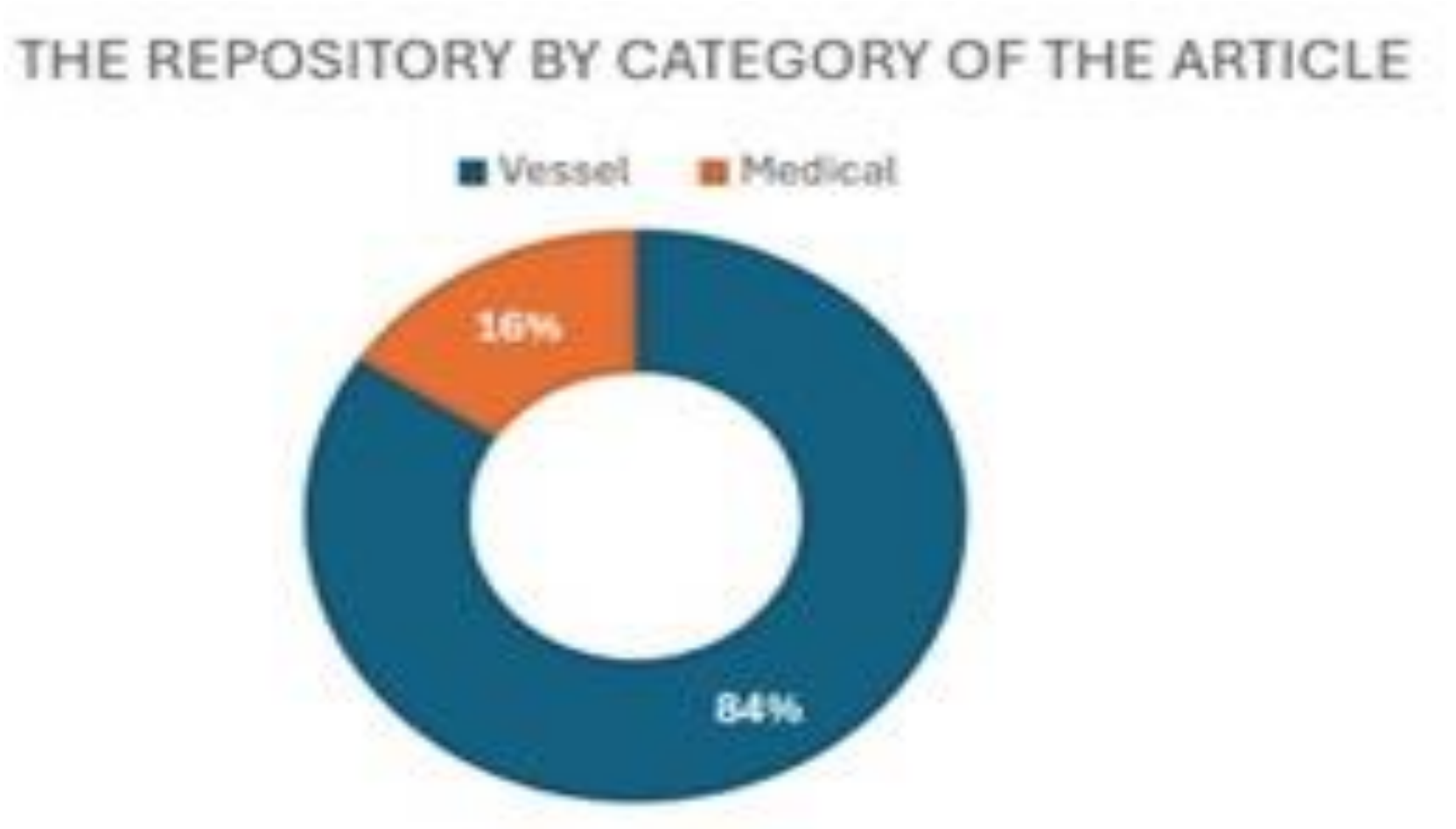
- 

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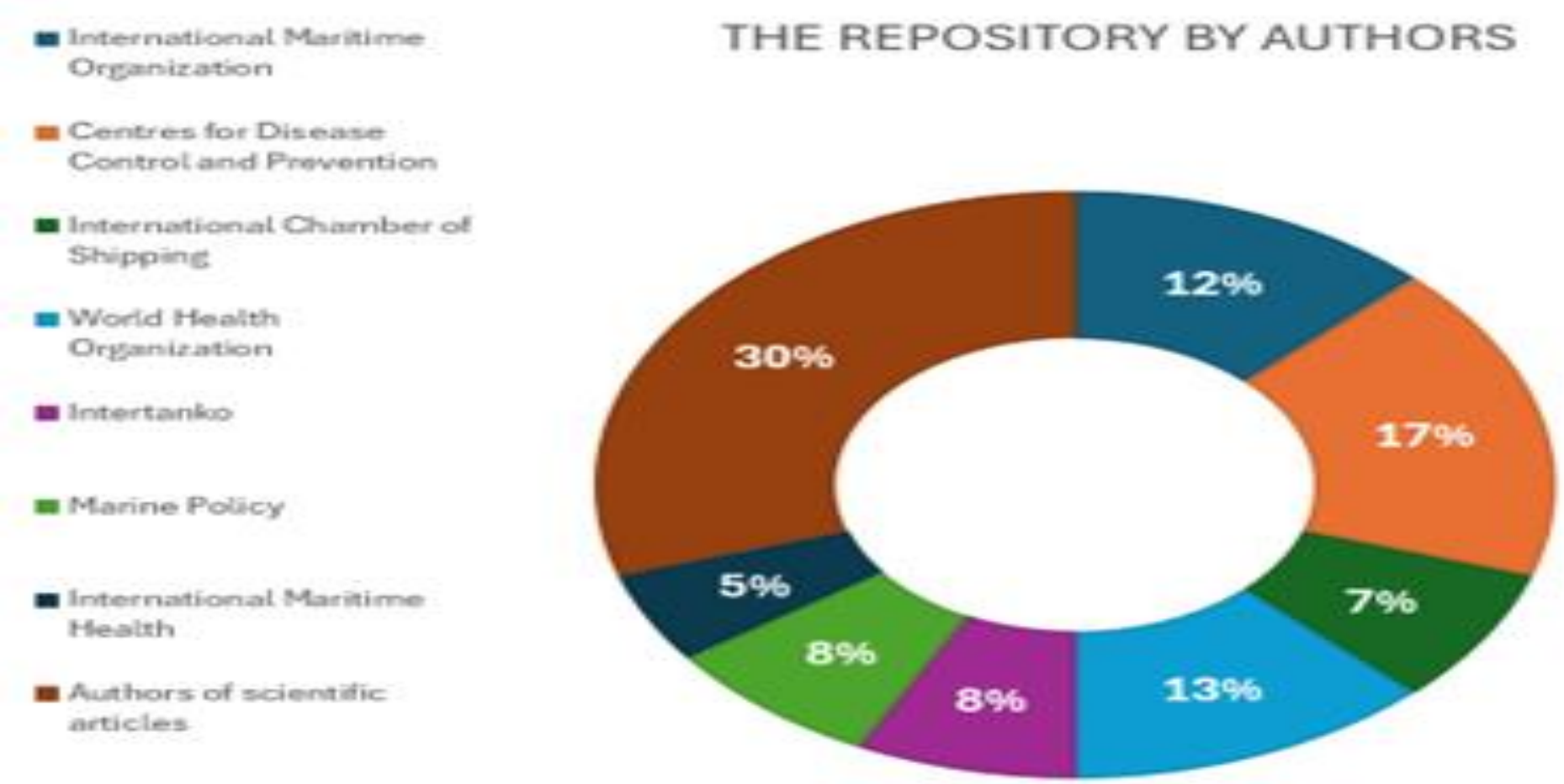

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KNOWLEDGE BASE OF SYMTOMS AND INFECTIOUS DISEASES

Drawing upon current statistics and data from leading health organisations such as the World Health - Organization (WHO, https://www.cdc.gov/nndss/index.html access by day 23 Feb 2024)

-Global Health Observatory (GHO), the Centers for Disease Control and Prevention (CDC, https://www.cdc.gov/nndss/index.html, access by day 23 Feb 2024) via

The National Notifiable Diseases Surveillance System (NNDSS), and the European Centre for Disease Prevention and Control (ECDC, https://atlas.ecdc.europa.eu/public/index.aspx access by day 23 Feb 2023)

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List of selected diseases:	
Chickenpox	Mumps
Chikungunya	Norovirus
Cholera	Pertussis
COVID-19	Rabies
Dengue	Rubella
Diphtheria	Tetanus
Ebola	Tuberculosis
Infectious mononucleosis	Typhoid and paratyphoid fever
Influenza	Hepatitis A
Malaria	Yellow fever
Meningococcal infection	Zika

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Groups of signs of infectious diseases			
1. General/systemic signs	continuous fever or fever with intervals less than 1 day intermittent fever every 2-4 days lethargy sweating and/or chills head pain lack of appetite and/or weight loss	5. Haematological symptoms	bleeding manifestations
2. Respiratory signs	chest pain cough phlegm shortness of breath sore throat runny nose	6. Gastric symptoms:	abdominal pain diarrhoea nausea vomiting
3. Musculoskeletal signs	back pain joint pain muscle pain lockjaw	7. Dermatological or associated signs:	neck swelling skin rash yellow skin and/or dark urine
4. Neurological signs	blurry vision cognitive difficulties difficulty swallowing dizziness emotional agitation neurological problems with sensation and movement seizures	8. Others signs:	fear of water testicular pain eye redness

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1. PREDICTION ALGORITHM

Patient	Symptom 1	Symptom 2	Symptom 3
1	1	1	1
2	1		1
3		1	1
4			1
5		1	1
6			1
7		1	1
8			1
	25%	50%	100%

- The naive bayes model (Hand, 2001) is a classifier which assumes that the symptoms are conditionally independent, given the target disease. This assumption's strength (naivety) is what gives the classifier its name.

- The decision tree model (Rokach, 2013) is a tree-like model of symptoms and their possible diseases, including chance event outcomes, resource costs, and utility. Each branch represents the outcome of the test (if a symptom is present or not), and each leaf node represents a disease. The paths from root to leaf represent classification rules are presented on Fig.

- Random forest model (Breiman, 2001) is based on the decision tree model, but in the random forest model, a forest (a big number) of decision trees is generated considering only some symptoms for each decision tree. The output of the random forest is the disease selected by most decision trees.

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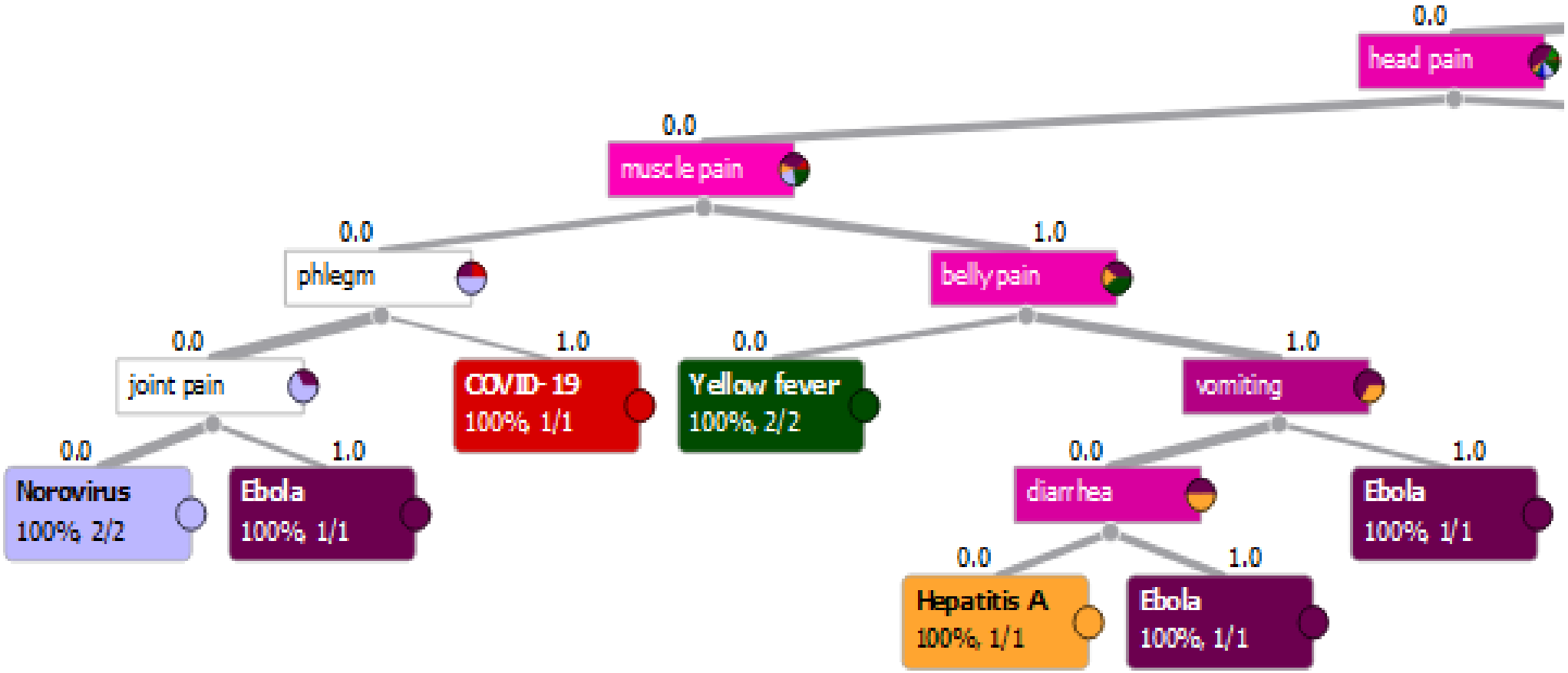

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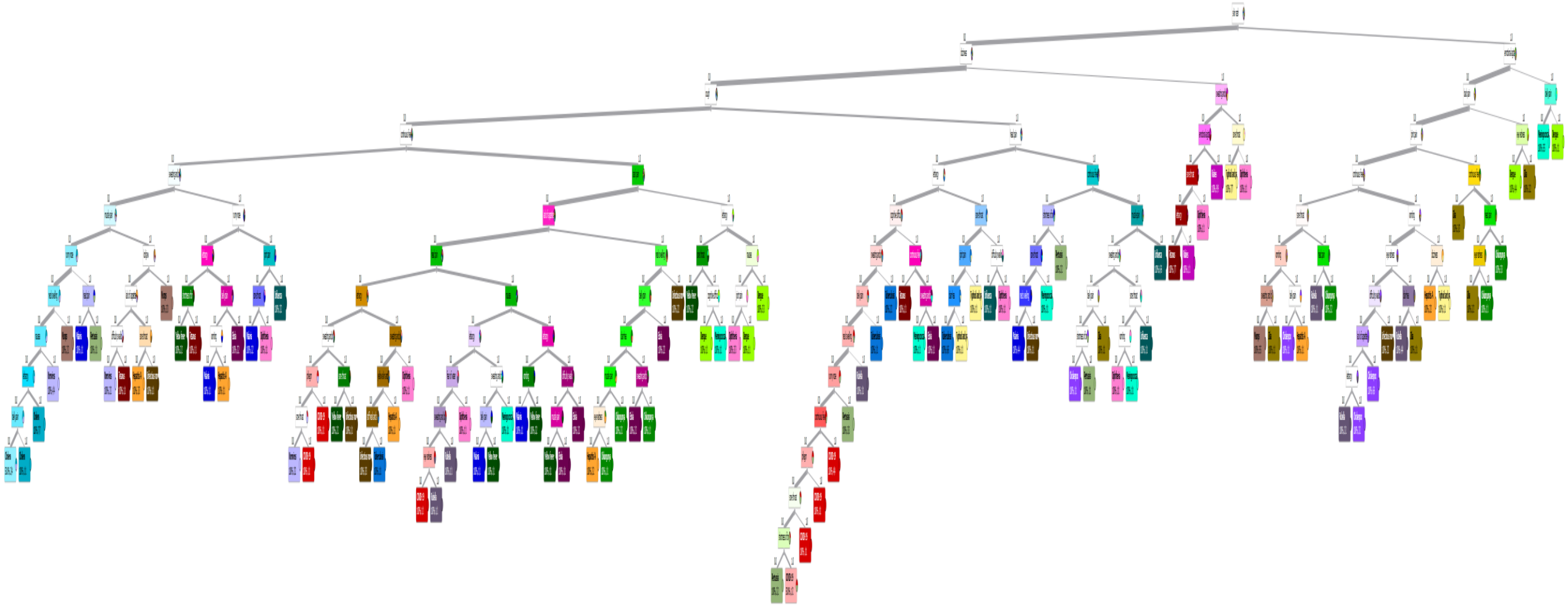

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Orange data mining software was used to build all three models. Orange data mining software is one of the software for machine learning and data mining. We used it as it is a free, widely used software from which the generated models can be exported and then used almost anywhere by using an Orange python library (Demsar J, Curk T, Erjavec A, Gorup C, Hocevar T, Milutinovic M, Mozina M, Polajnar M, Toplak M, Staric A, Stajdohar M, Umek L, Zagar L, Zbontar J, Zitnik M, Zupan B (2013) Orange: Data Mining Toolbox in Python, Journal of Machine Learning Research 14(Aug): 2349−2353. http://jmlr.org/papers/volume14/demsar13a/demsar13a.pdf). This allows us to easily integrate the prediction algorithm into the website and mobile app and make it publicly available.

On the following image is the visualisation of the project in Orange data mining software.

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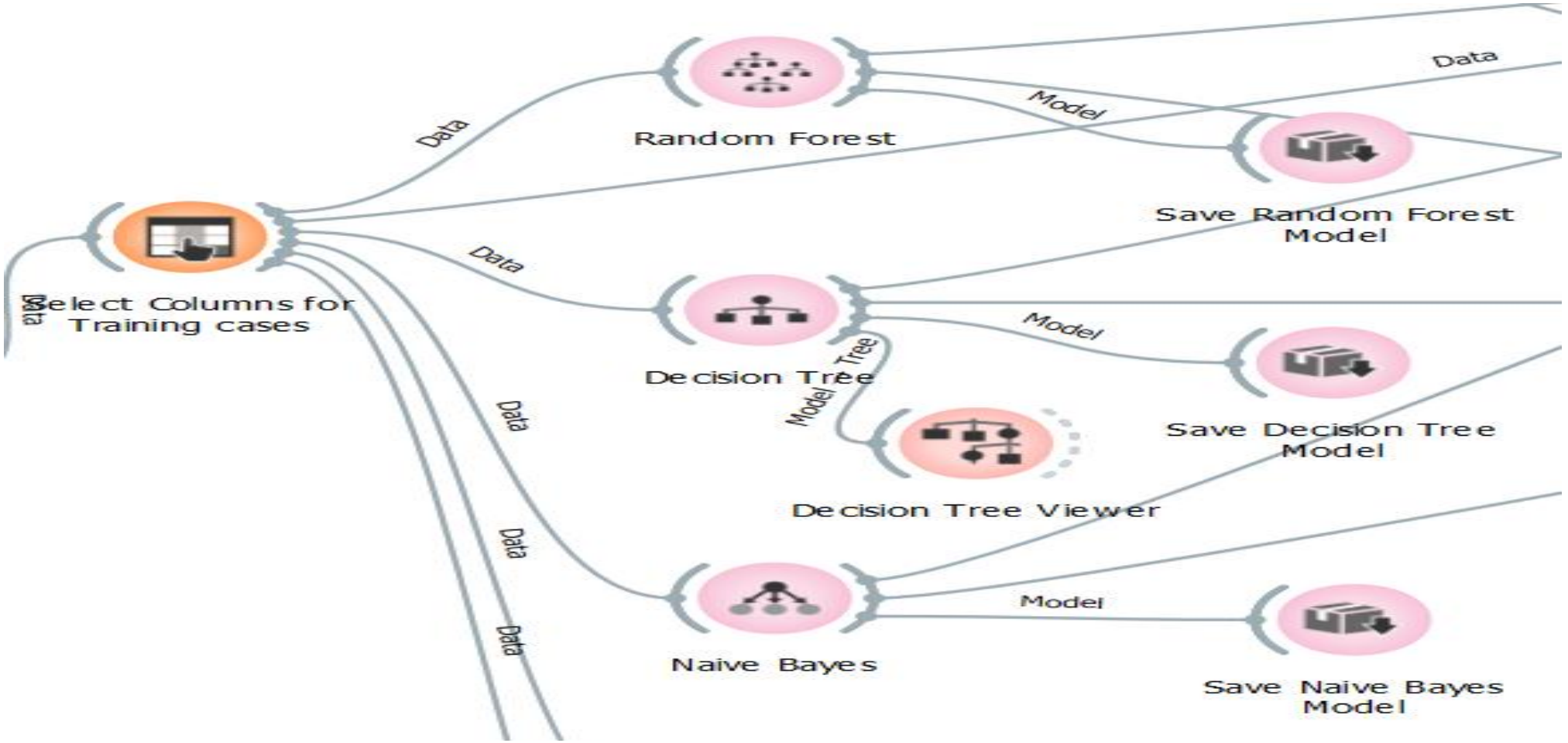

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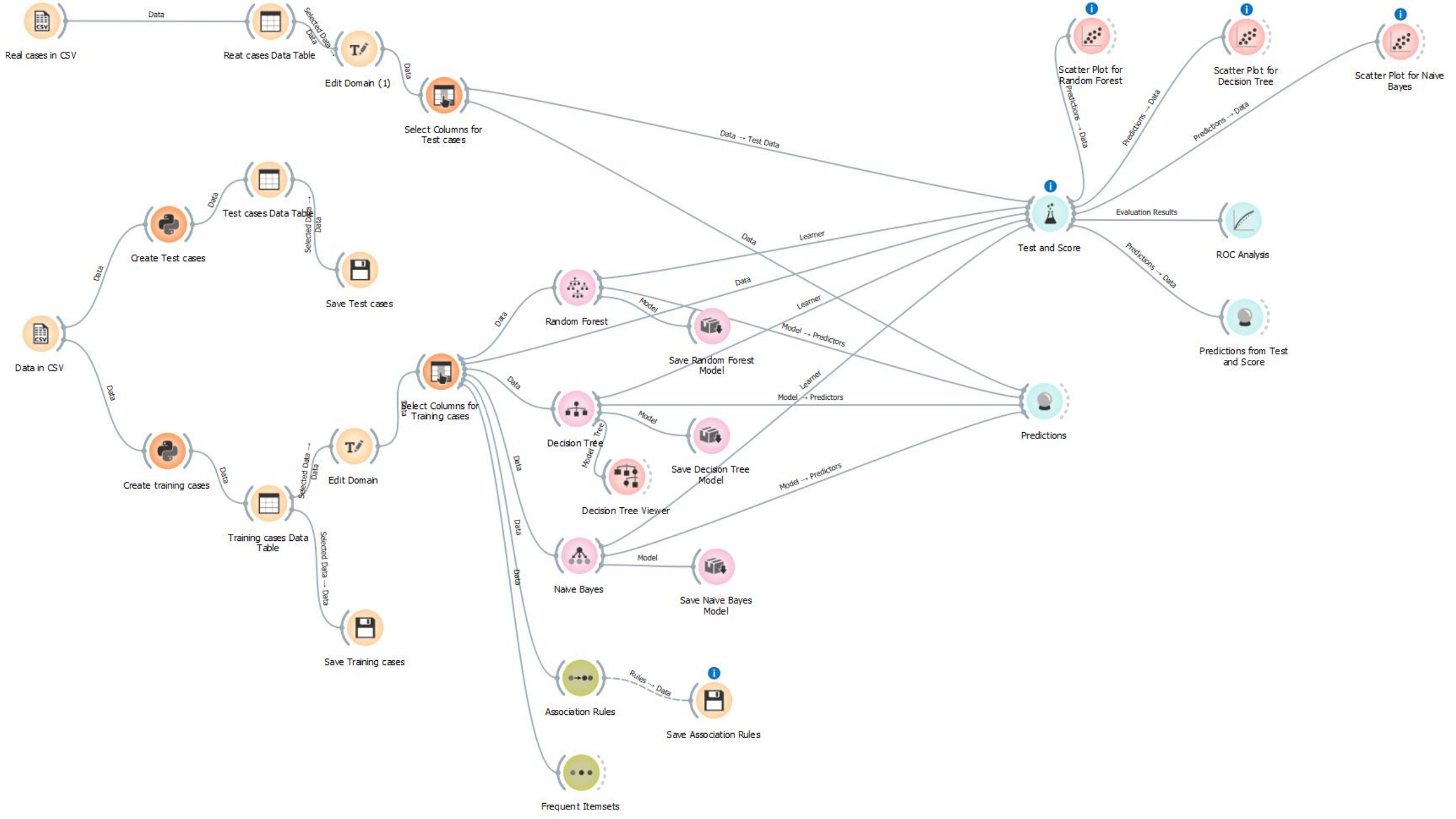
Real cases in CSV
Data
Reat cases Data Table
Selected Data → Data
Edit Domain (1)
Data
Select Columns for Test cases
Data → Test Data
Scatter Plot for Random Forest
Predictions → Data
Scatter Plot for Decision Tree
Predictions → Data
Scatter Plot for Naive Bayes
Predictions → Data
Test and Score
Evaluation Results
ROC Analysis
Predictions → Data
Predictions from Test and Score
Data in CSV
Data
Create Test cases
Data
Test cases Data Table
Selected Data → Data
Save Test cases
Data
Create training cases
Data
Training cases Data Table
Selected Data → Data
Edit Domain
Selected Data → Data
Save Training cases
Select Columns for Training cases
Data
Random Forest
Model
Save Random Forest Model
Data
Learner
Model → Predictors
Data
Decision Tree
Model
Save Decision Tree Model
Model Tree
Decision Tree Viewer
Learner
Model → Predictors
Data
Naive Bayes
Model
Save Naive Bayes Model
Model → Predictors
Predictions
Data
Association Rules
Rules → Data
Save Association Rules
Data
Frequent Itemsets

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- The classification accuracy of all three models when tested on test data was as follows:

  - random forest: 100%
  - decision tree: 57%
  - naive bayes: 86%

- In our prediction algorithm, the random forest model outperforms other models like in most similar applications in the medicine field (Sumwiza at all., 2023). These results confirm that the random forest model is the best model for disease prediction in the medicine field.).

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CONCLUSION

- This article introduced a tool established as a delivery of the DESSEV project. The online tool is available for seafarers with low thresholds, shortlisting the possible diagnosis based on the most likely causes of symptoms.
- First, the online users of the tool are not medical professionals. The online tool inevitably introduces seagoing personnel with unfamiliar medical terms and expressions
- Second, the online repository provides onboard personnel with timely and peer-reviewed information on infectious diseases.
- Third, the practical implementation of the online tool requires co-existence with the shipping company's prevailing safety management system.
- Finally, it is noteworthy that the online tool is not meant to be a substitute for professional medical care. Under all circumstances, all effort must be seen to seek shoreside medical assistance.
- **https://dessevproject.eu**

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- ANY QUESTIONS?
- THANK YOU VERY MUCH

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