

Decision Management Community

2021-August Challenge “[Titanic Booking Service](#)”

Solution provided by Prof. [Gopal Gupta](#)
and his colleagues Huaduo Wang & Parth Padalkar at UT Dallas

We tried our new KMeans-Fold Explainable AI tool to the Titanic training data to generate ASP rules. These rules are a collection of defaults and exceptions. Accuracy is **88.3**. We generate 26 rules (8 default rules, 18 exception rules). Rules are reproduced below in ASP (they actually run on our *s*(CASP) system) and in plain English.

We are trying our SHAP-FOLD system to see if we can increase the accuracy (but very likely the number of rules will increase).

The English translation that *s*(CASP) produces for these rules can be found [here](#):

```
% USER PREDICATES:
person Var0 survived, if
    person Var0 is female and
    person Var0 traveled in 1st class.
person Var0 survived, if
    person Var0 is female and
    person Var0 traveled in 2nd class.
person Var0 survived, if
    person Var0 is female and
    person Var0 had Var1 parents or children and
    Var1 is greater than 0.0 and
    person Var0 traveled in 1st class and
    there is no evidence that abnormal case 2 holds for Var0.

abnormal case 2 holds for Var0, if
    person Var0 is of age Var1 and
    Var1 is greater than 22.0.

person Var0 survived, if
    person Var0 is female and
    person Var0 traveled in 1st class and
    there is no evidence that abnormal case 4 holds for Var0 and
    there is no evidence that abnormal case 9 holds for Var0.

abnormal case 4 holds for Var0, if
    person Var0 paid Var1 for the ticket and
    Var1 is less or equal 28.712 and
    there is no evidence that abnormal case 3 holds for Var0.
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abnormal case 3 holds for Var0, if
person Var0 had Var1 parents or children and
Var1 is greater than 0.0.

abnormal case 9 holds for Var0, if
person Var0 embarked from Var1 and
there is no evidence that abnormal case 5 holds for Var0 and
there is no evidence that abnormal case 8 holds for Var0.

abnormal case 8 holds for Var0, if
person Var0 paid Var1 for the ticket and
Var1 is greater than 26.283 and
there is no evidence that abnormal case 7 holds for Var0.

abnormal case 7 holds for Var0, if
person Var0 is of age Var1 and
Var1 is greater than 18.0 and
there is no evidence that abnormal case 6 holds for Var0.

abnormal case 6 holds for Var0, if
person Var0 is of age Var1 and
Var1 is greater than 25.0.

abnormal case 5 holds for Var0, if
person Var0 paid Var1 for the ticket and
Var1 is greater than 151.55.

person Var0 survived, if
person Var0 is female and
person Var0 embarked from Var1 and
there is no evidence that abnormal case 10 holds for Var0 and
there is no evidence that abnormal case 12 holds for Var0.

abnormal case 12 holds for Var0, if
person Var0 paid Var1 for the ticket and
Var1 is less or equal 15.246 and
there is no evidence that abnormal case 11 holds for Var0.

abnormal case 11 holds for Var0, if
person Var0 is of age Var1 and
Var1 is less or equal 29.0.

abnormal case 10 holds for Var0, if
person Var0 had Var1 parents or children and
Var1 is less or equal 1.0.

person Var0 survived, if
person Var0 is female and
person Var0 embarked from Var1 and
there is no evidence that abnormal case 16 holds for Var0.

abnormal case 16 holds for Var0, if
person Var0 is of age Var1 and
Var1 is greater than 16.0 and
there is no evidence that abnormal case 15 holds for Var0.

abnormal case 15 holds for Var0, if

person Var0 is of age Var1 and
Var1 is less or equal 30.0 and
there is no evidence that abnormal case 14 holds for Var0.

abnormal case 14 holds for Var0, if
person Var0 paid Var1 for the ticket and
Var1 is less or equal 7.75 and
there is no evidence that abnormal case 13 holds for Var0.

abnormal case 13 holds for Var0, if
person Var0 is of age Var1 and
Var1 is greater than 21.0.

person Var0 survived, if
person Var0 is female and
person Var0 embarked from Var1 and
there is no evidence that abnormal case 19 holds for Var0.

abnormal case 19 holds for Var0, if
person Var0 paid Var1 for the ticket and
Var1 is greater than 7.229 and
there is no evidence that abnormal case 18 holds for Var0.

abnormal case 18 holds for Var0, if
person Var0 had Var1 siblings or spouses and
Var1 is greater than 0.0 and
there is no evidence that abnormal case 17 holds for Var0.

abnormal case 17 holds for Var0, if
person Var0 paid Var1 for the ticket and
Var1 is less or equal 15.246.

person Var0 survived, if
person Var0 is female and
person Var0 is of age Var1 and
Var1 is greater than 57.0.

%ASP code:

survived(X):-sex(X,female),class(X,1).
survived(X):-sex(X,female),class(X,2).
%
survived(X):-sex(X,female),number_of_parents_children(X,N3),N3>0.0,class(X,1),not ab2(X).
ab2(X):-age(X,N1),N1>22.0.
%
survived(X):-sex(X,female),class(X,1),not ab4(X),not ab9(X).
ab4(X):-fare(X,N4),N4=<28.712,not ab3(X).
ab3(X):-number_of_parents_children(X,N3),N3>0.0.

ab9(X):-embarked(X,S),not ab5(X),not ab8(X).

ab8(X):-fare(X,N4),N4>26.283,not ab7(X).

ab7(X):-age(X,N1),N1>18.0,not ab6(X).

ab6(X):-age(X,N1),N1>25.0.

ab5(X):-fare(X,N4),N4>151.55.

%

survived(X):-sex(X,female),embarked(X,C),not ab10(X),not ab12(X).

ab12(X):-fare(X,N4),N4=<15.246,not ab11(X).

ab11(X):-age(X,N1),N1=<29.0.

ab10(X):-number_of_parents_children(X,N3),N3=<1.0.

%

survived(X):-sex(X,female),embarked(X,Q),not ab16(X).

ab16(X):-age(X,N1),N1>16.0,not ab15(X).

ab15(X):-age(X,N1),N1=<30.0,not ab14(X).

ab14(X):-fare(X,N4),N4=<7.75,not ab13(X).

ab13(X):-age(X,N1),N1>21.0.

%

survived(X):-sex(X,female),embarked(X,C),not ab19(X).

ab19(X):-fare(X,N4),N4>7.229,not ab18(X).

ab18(X):-number_of_sibling_spouses(X,N2),N2>0.0,not ab17(X).

ab17(X):-fare(X,N4),N4=<15.246.

%

survived(X):-sex(X,female),age(X,N1),N1>57.0.

%%%%%%%%%