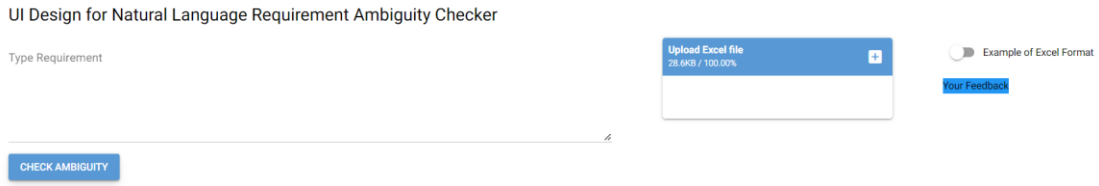
How to use the User Interface

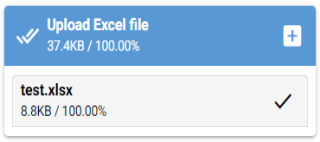
Once you run the Gui.py the web app will open in local host. The user interface is created by using NiceGui (https://nicegui.io/documentation#server_hosting), an open-source Python library for creating user friendly graphical interfaces.

The title in the web app *UI Design for Natural Language Requirement Ambiguity Checker* suggests that it is intended to be used to check ambiguities in requirements in natural language.

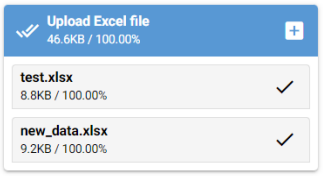


The user can type in a text requirement. The requirement might consist of one or more sentences. It should be in English, as the parser used in the models for English. If you write a requirement in another language the tool will classify it probably as Ambiguous. Once you type a requirement you can click CHECK AMBIGUTY to get the classification result.

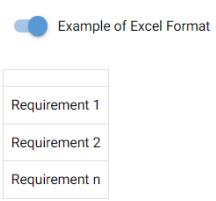
The user may also upload an Excel file using the Upload Excel File button (by clicking +). After your file has been uploaded, you will see a double tick on the left and the button displaying the file name and size. A prompt stating, Your file is uploaded will also appear.



You can upload many files, but you can only examine one file at a time for ambiguity. In the example below the *upload new_data.xlsx* is uploaded and the result for that file will appear in the OUTPUT. By selecting the *single tick* ✓, you can remove a file, and by selecting the *double tick* ✓✓, you can erase all of the files.



The file must be in Excel format, with requirement in each row and optional comments.

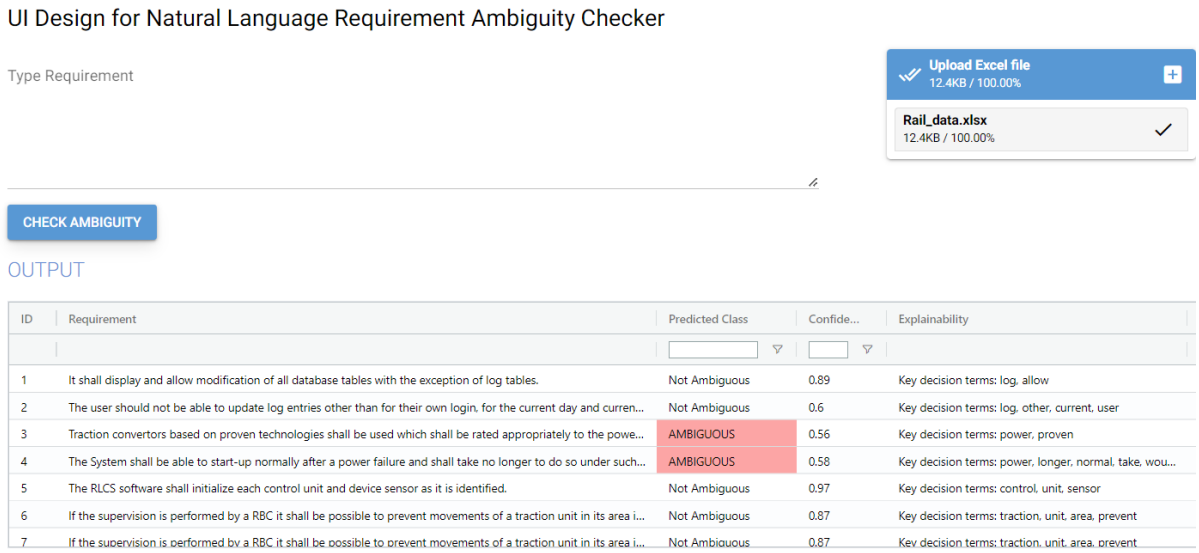


The excel file shouldn't contain column names; if it does, it will be considered as a requirement (see first row). Ensure that the file's headers are removed.

OUTPUT

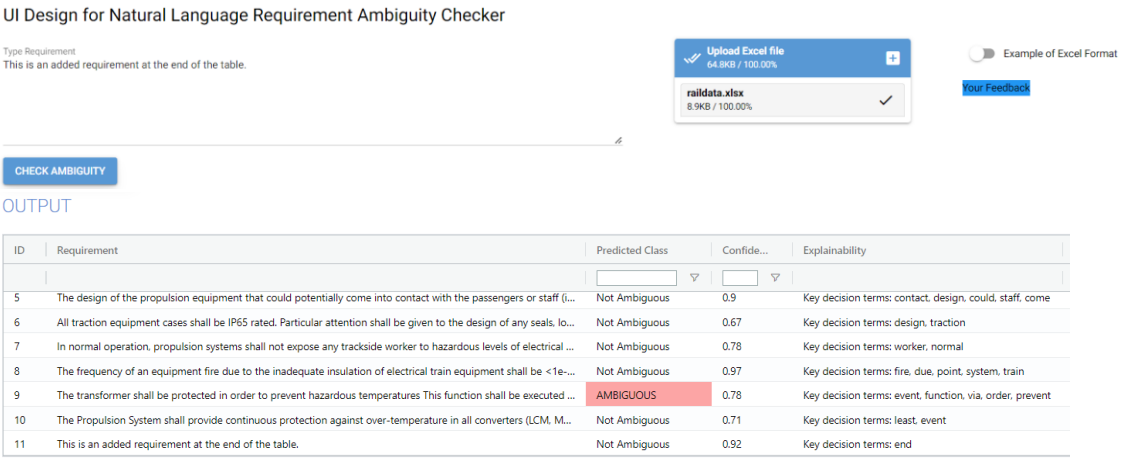
ID	Requirement	Predicted Class	Confidence	Explainability
1	Requirement	Not Ambiguous	0.91	Key decision terms:
2	It shall take no longer than the stated time to complete the following task: Pantograph (complete) - Exchange, 6...	Not Ambiguous	0.96	Key decision terms: take, longer, time

The Check Ambiguity button contains the logic of the models. It invokes the trained models (SVM for classification and Decision Tree for term extraction) to categorize the requirements. After pressing the button, the prediction is applied to the given data, and the outcomes are shown in the OUTPUT table. In the example below, some public accessible data given as *Rail_data.xlsx* was used by the model to present the classification below.



ID	Requirement	Predicted Class	Confide...	Explainability
1	It shall display and allow modification of all database tables with the exception of log tables.	Not Ambiguous	0.89	Key decision terms: log, allow
2	The user should not be able to update log entries other than for their own login, for the current day and curren...	Not Ambiguous	0.6	Key decision terms: log, other, current, user
3	Traction convertors based on proven technologies shall be used which shall be rated appropriately to the powe...	AMBIGUOUS	0.56	Key decision terms: power, proven
4	The System shall be able to start-up normally after a power failure and shall take no longer to do so under such...	AMBIGUOUS	0.58	Key decision terms: power, longer, normal, take, wou...
5	The RLCS software shall initialize each control unit and device sensor as it is identified.	Not Ambiguous	0.97	Key decision terms: control, unit, sensor
6	If the supervision is performed by a RBC it shall be possible to prevent movements of a traction unit in its area i...	Not Ambiguous	0.87	Key decision terms: traction, unit, area, prevent
7	If the supervision is performed by a RBC it shall be possible to prevent movements of a traction unit in its area i...	Not Ambiguous	0.87	Key decision terms: traction, unit, area, prevent

The output will be unique for each file provided (if you want to mix numerous files, merge them in your computer and then upload one file). However, if you want to add a requirement in the text area, you can do so, and it will be added as the last row in the table. You can also write in all the requirements in the text area, which will be added and displayed in the tables (see below requirement with id 6 is added from text area).



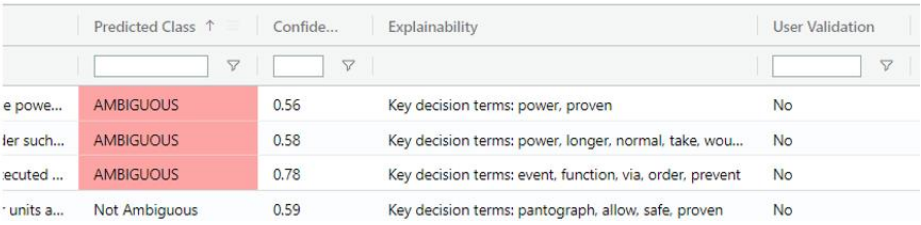
ID	Requirement	Predicted Class	Confide...	Explainability
5	The design of the propulsion equipment that could potentially come into contact with the passengers or staff (i...	Not Ambiguous	0.9	Key decision terms: contact, design, could, staff, come
6	All traction equipment cases shall be IP65 rated. Particular attention shall be given to the design of any seals, lo...	Not Ambiguous	0.67	Key decision terms: design, traction
7	In normal operation, propulsion systems shall not expose any trackside worker to hazardous levels of electrical ...	Not Ambiguous	0.78	Key decision terms: worker, normal
8	The frequency of an equipment fire due to the inadequate insulation of electrical train equipment shall be <1e-...	Not Ambiguous	0.97	Key decision terms: fire, due, point, system, train
9	The transformer shall be protected in order to prevent hazardous temperatures This function shall be executed ...	AMBIGUOUS	0.78	Key decision terms: event, function, via, order, prevent
10	The Propulsion System shall provide continuous protection against over-temperature in all converters (LCM, M...	Not Ambiguous	0.71	Key decision terms: least, event
11	This is an added requirement at the end of the table.	Not Ambiguous	0.92	Key decision terms: end

The output will be:

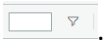
- ***ID***: unique for each requirement.
- ***Requirement***: contains requirements from uploaded file or typed in the text area-
- ***Predicted Class***: model's prediction as AMBIGUOUS or Not Ambiguous.
- ***Confidence***: confidence level of the classification.
- ***Explainability***: provides the terms that the model has use to classify each requirement in the class ambiguous or not. The terms for the AMBIGUOUS requirements contribute to the classification of the requirement as AMBIGUOUS.
- ***User Validation***: editable column, where the user can type the validation as *Yes* for *AMBIGUOUS* or *No* for *Not Ambiguous*. By default, all the values here are No, and they can be changed. All ways are considered, so the model will recognize if the user writes Yes, YES, yes (No, NO, no).
- ***Feedback***: The user can input sentence(s) to offer feedback on the classification, which will be utilized in a later version of the model that incorporates feedback. It would be helpful to add comments for ambiguous terms/sentences to assist the models become more distinct.

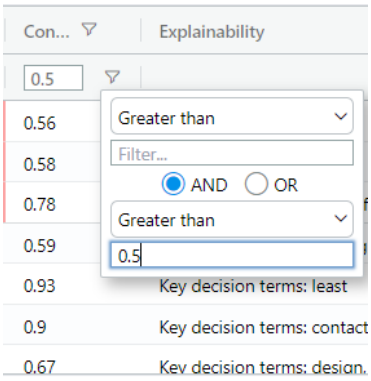
Filters

The column Predicted Class, Confidence and User Validation are equipped with filtering option. By clicking at the column name, you can automatically sort the column values (for example column Confidence can be ordered by id (by default), by clicking at Confidence name you can order in ascending and descending order), same for Predicted Class and User Validation.

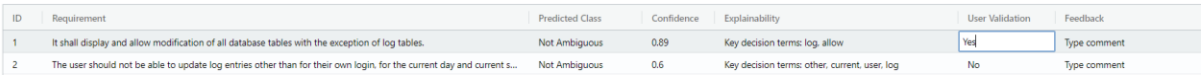


	Predicted Class	Confide...	Explainability	User Validation
e powe...	AMBIGUOUS	0.56	Key decision terms: power, proven	No
ler such...	AMBIGUOUS	0.58	Key decision terms: power, longer, normal, take, wou...	No
ecuted ...	AMBIGUOUS	0.78	Key decision terms: event, function, via, order, prevent	No
units a...	Not Ambiguous	0.59	Key decision terms: pantograph, allow, safe, proven	No

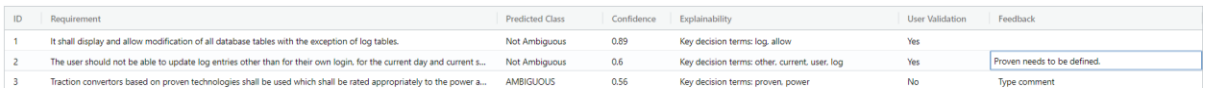
Furthermore, the columns have advanced filter options  . The column Confidence has filtered all the values greater than 0.5.



How to provide feedback



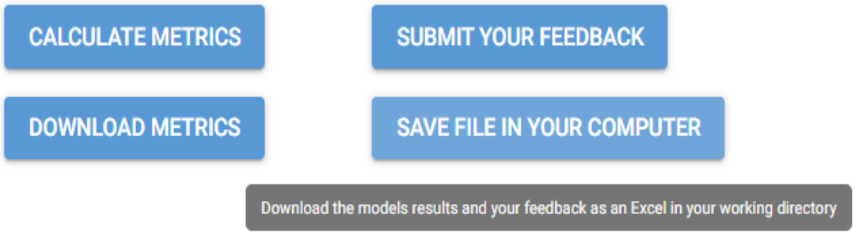
ID	Requirement	Predicted Class	Confidence	Explainability	User Validation	Feedback
1	It shall display and allow modification of all database tables with the exception of log tables.	Not Ambiguous	0.89	Key decision terms: log, allow	Yes	Type comment
2	The user should not be able to update log entries other than for their own login, for the current day and current s...	Not Ambiguous	0.6	Key decision terms: other, current, user, log	No	Type comment



ID	Requirement	Predicted Class	Confidence	Explainability	User Validation	Feedback
1	It shall display and allow modification of all database tables with the exception of log tables.	Not Ambiguous	0.89	Key decision terms: log, allow	Yes	
2	The user should not be able to update log entries other than for their own login, for the current day and current s...	Not Ambiguous	0.6	Key decision terms: other, current, user, log	Yes	Proven needs to be defined.
3	Traction convertors based on proven technologies shall be used which shall be rated appropriately to the power a...	AMBIGUOUS	0.56	Key decision terms: proven, power	No	Type comment

The user can click on each row to offer validation or feedback, and then save them by using the SUBMIT YOUR FEEDBACK button.

SUBMIT YOUR FEEDBACK will be updated and save all your inputs. Make sure to click it in case you make any changes.



CALCULATE METRICS – Once clicked, the button will compute the following metrics: True Positives (TP), True Negatives (TN), False Positives (FP), False Negatives (FN), Accuracy, Predicted Class Percentage (Ambiguous), Predicted Class Percentage (Not Ambiguous). The Predicted Class and User Validation will be used to compute True Positives, True Negatives, False Positives, False Negatives, and Accuracy. Only the Predicted Class will calculate the percentage of Ambiguous and the percentage of not Ambiguous requirements. Remember that these metrics are derived from the requirements you input and have nothing to do with how the model performed during training. They are also sensitive to the User Validation input.

TP provides the number of correct predictions among positive instances (Requirement is Ambiguous and is classified as so).

TN provides the number of correct predictions among negative instances (Requirement is Not Ambiguous and is classified as so).

FP provides the number of incorrect predictions (requirement is Not Ambiguous and is classified as Ambiguous).

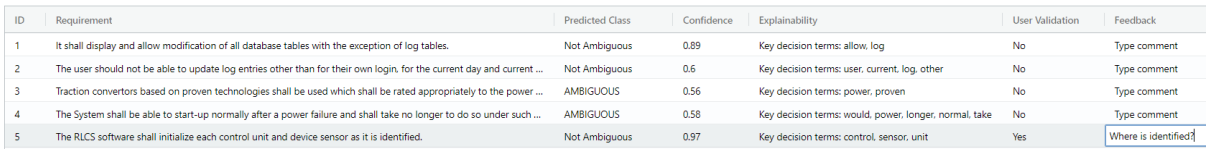
FN provides the number of incorrect predictions (requirement is Ambiguous and is classified as Not Ambiguous).

Accuracy provides an estimation of how correct the model performed on the classification.

Predicted Class % (Ambiguous), Predicted Class % (Not Ambiguous) provide the % on how many the model classified as ambiguous and not ambiguous.

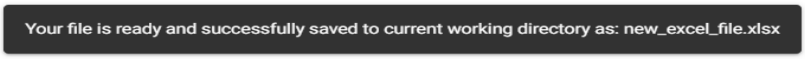
DOWNLOAD METRICS, the user can download the metrics locally on the computer. The metrics are saved in a text file called ***metrics.txt*** and are updated whenever the button is pressed. If you wish to keep the previous saved metrics, create a copy on your computer. The file *metrics.txt* will be produced automatically in your working directory (the location where you save the Python code).

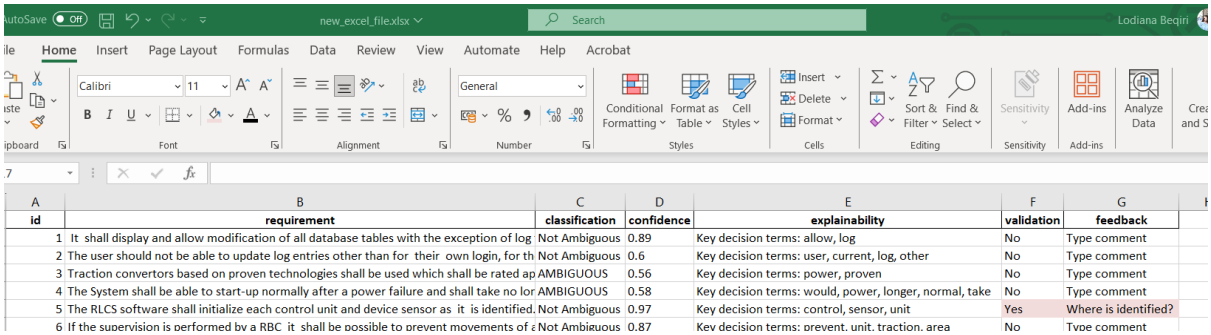
SAVE FILE IN YOUR COMPUTER will save the table with the results in your working directory (same as metrics.txt) with the name ***new_excel_file.xlsx.*** Make sure to make a copy for every version you need, since the file gets updated every time the button is clicked.



ID	Requirement	Predicted Class	Confidence	Explainability	User Validation	Feedback
1	It shall display and allow modification of all database tables with the exception of log tables.	Not Ambiguous	0.89	Key decision terms: allow, log	No	Type comment
2	The user should not be able to update log entries other than for their own login, for the current day and current ...	Not Ambiguous	0.6	Key decision terms: user, current, log, other	No	Type comment
3	Traction convertors based on proven technologies shall be used which shall be rated appropriately to the power ...	AMBIGUOUS	0.56	Key decision terms: power, proven	No	Type comment
4	The System shall be able to start-up normally after a power failure and shall take no longer to do so under such ...	AMBIGUOUS	0.58	Key decision terms: would, power, longer, normal, take	No	Type comment
5	The RLCS software shall initialize each control unit and device sensor as it is identified.	Not Ambiguous	0.97	Key decision terms: control, sensor, unit	Yes	Where is identified?

In the example below, I added for requirement with id 5 "*Yes"* and "*Where is identified?*" as a comment. Once saved clicked SAVE FILE IN YOUR COMPUTER the prompt below will show and the table will be saved as an excel in your working directory.





	A	B	C	D	E	F	G
	id	requirement	classification	confidence	explainability	validation	feedback
1	1	It shall display and allow modification of all database tables with the exception of log	Not Ambiguous	0.89	Key decision terms: allow, log	No	Type comment
2	2	The user should not be able to update log entries other than for their own login, for th	Not Ambiguous	0.6	Key decision terms: user, current, log, other	No	Type comment
3	3	Traction convertors based on proven technologies shall be used which shall be rated ap	AMBIGUOUS	0.56	Key decision terms: power, proven	No	Type comment
4	4	The System shall be able to start-up normally after a power failure and shall take no lor	AMBIGUOUS	0.58	Key decision terms: would, power, longer, normal, take	No	Type comment
5	5	The RLCS software shall initialize each control unit and device sensor as it is identified.	Not Ambiguous	0.97	Key decision terms: control, sensor, unit	Yes	Where is identified?
6	6	If the supervision is performed by a RBC it shall be possible to prevent movements of a	Not Ambiguous	0.87	Key decision terms: prevent, unit, traction, area	No	Type comment

If you attempt to click the button without submitting the changes: (User validation, Feedback) you will receive a prompt: Please click 'Submit Changes' first.