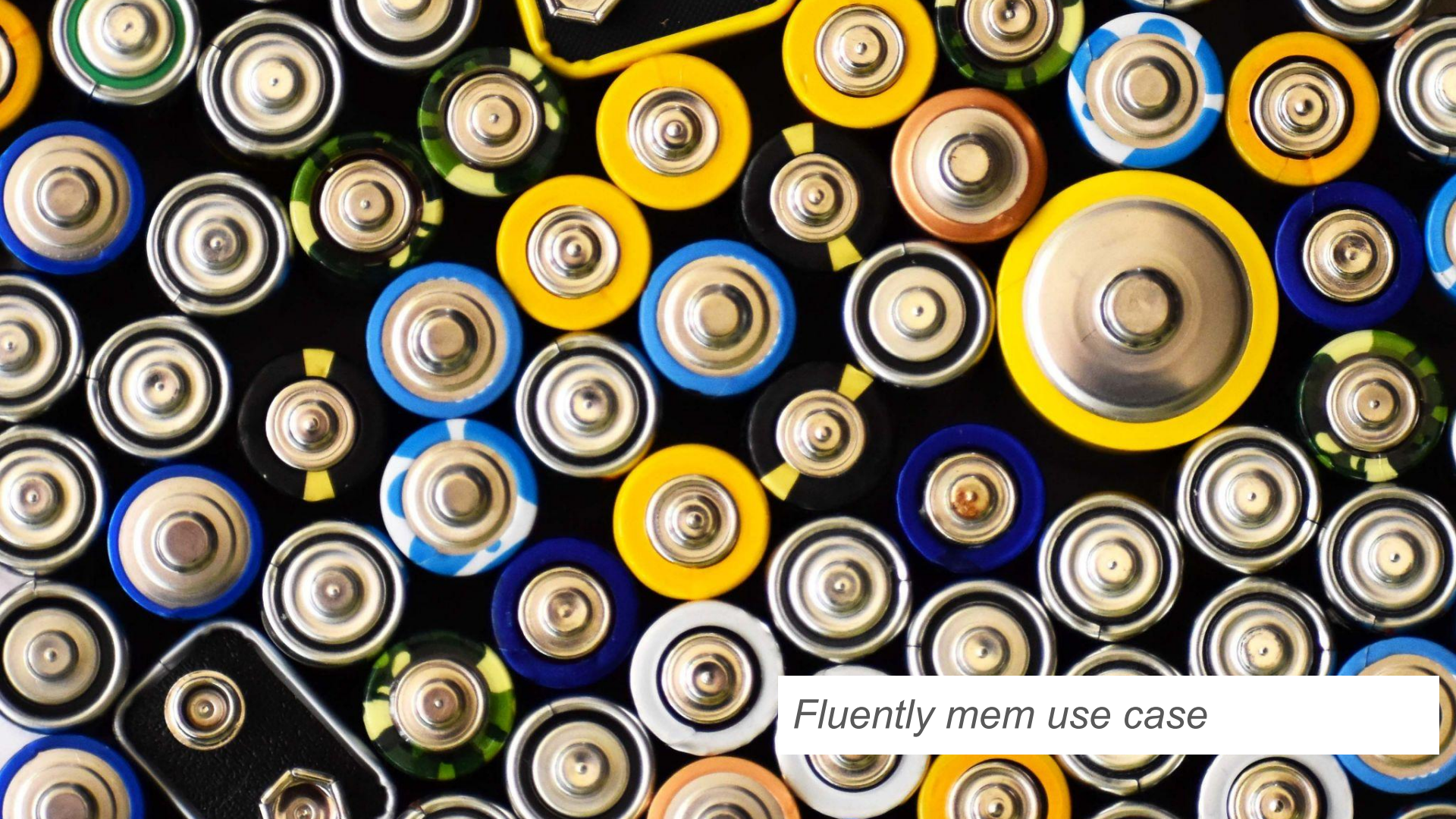
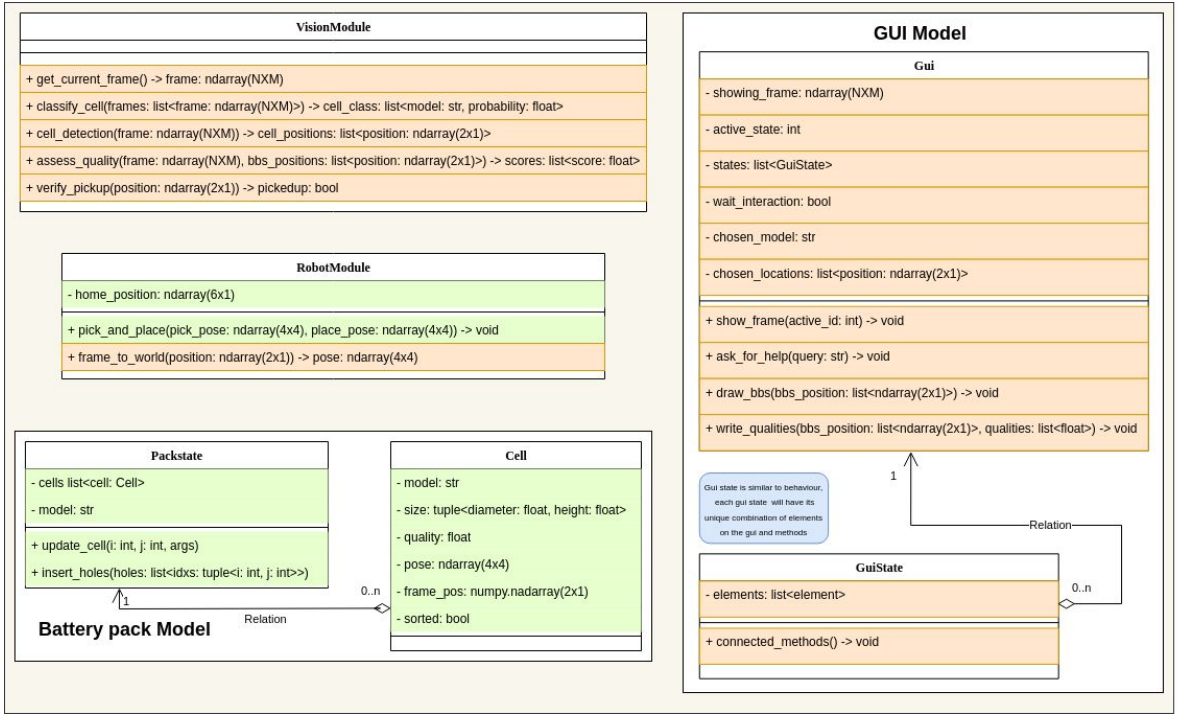
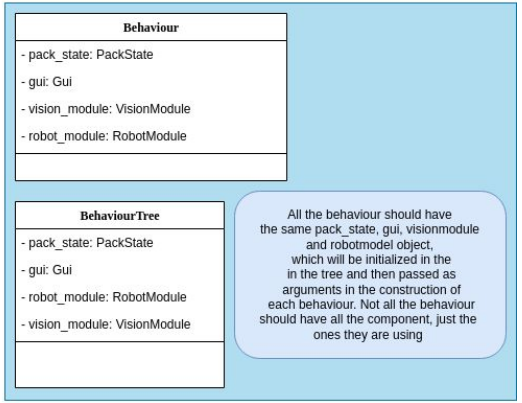
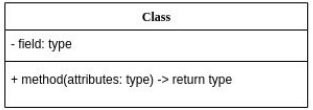


Fluently mem use case

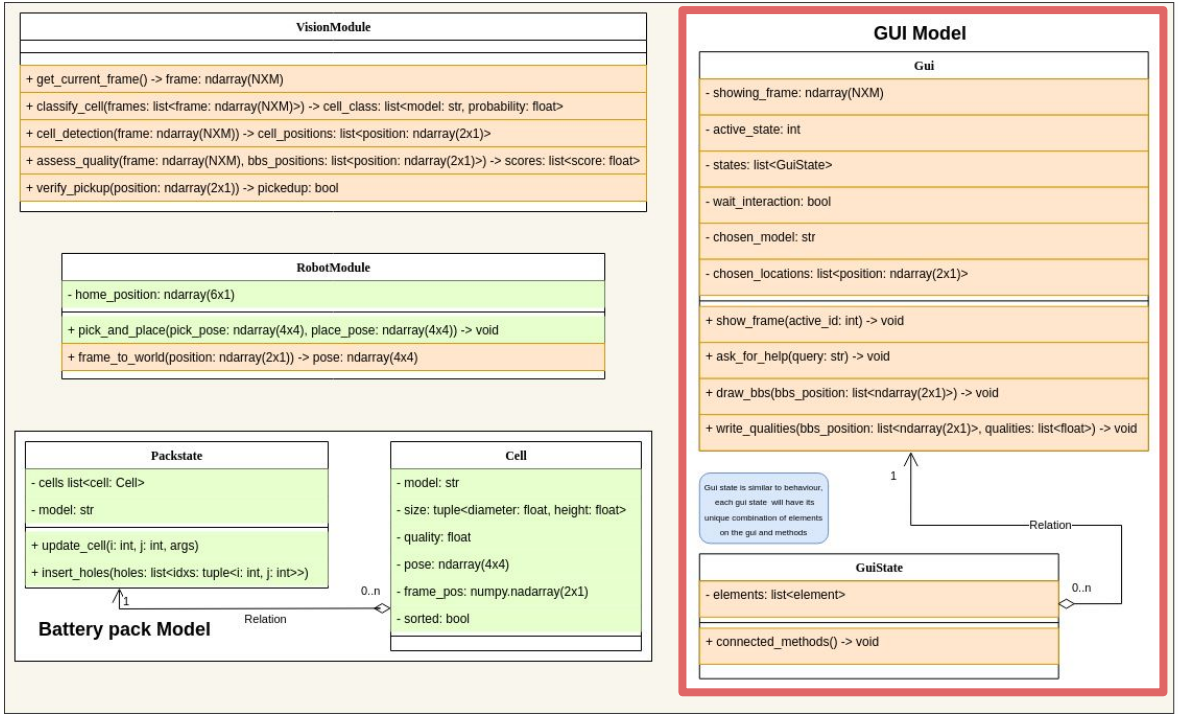
Software diagram

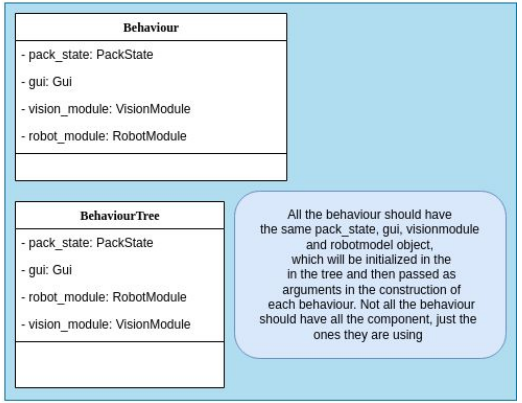


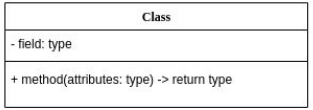




Software diagram

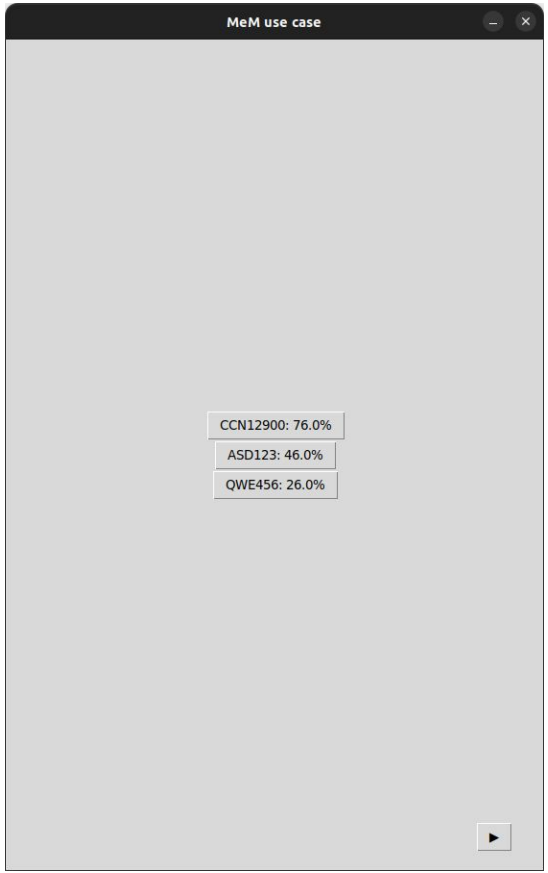






The system produces a prediction for the model in the picture, based on the camera input. The user can confirm or deny the prediction

If the system did not predict the correct model, the user will be presented with some other candidates and with an entry where they can insert a new model. The entry to insert custom cell has to be implemented

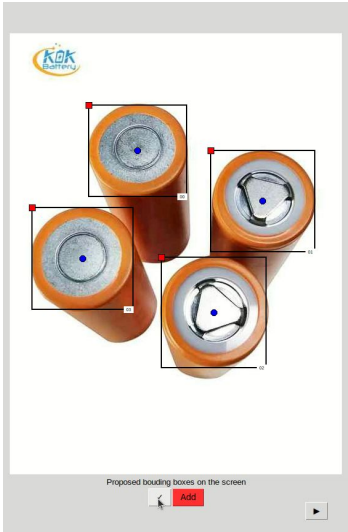


If the system predicted correctly, it produces some bounding box candidates.

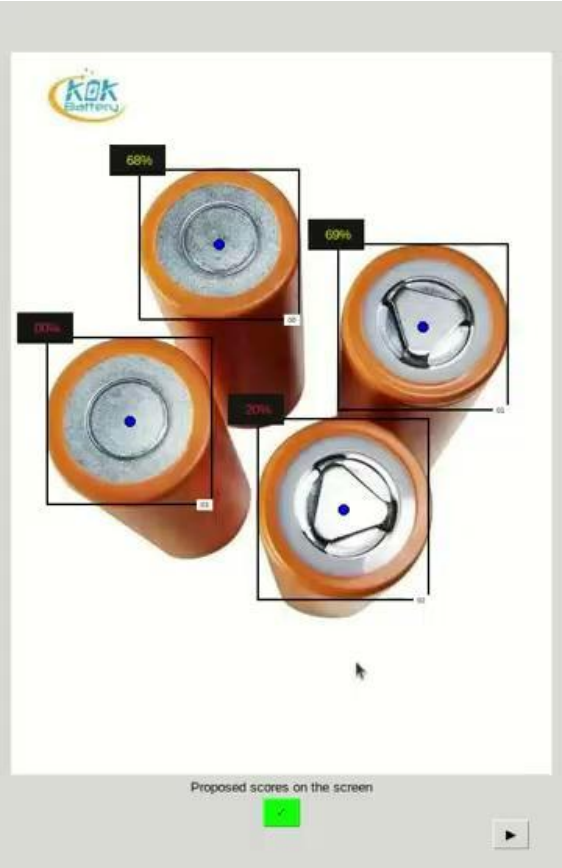
The user can resize and move the bounding boxes presents on the GUI and can create new bounding boxes in case the system missed some cell.

A function to delete incorrect bounding boxes has to be implemented

When the user think the bounding boxes cover the cells they can continue

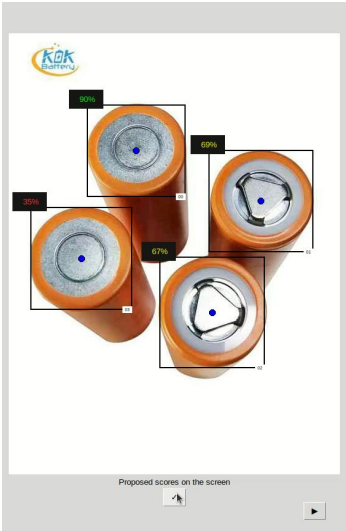


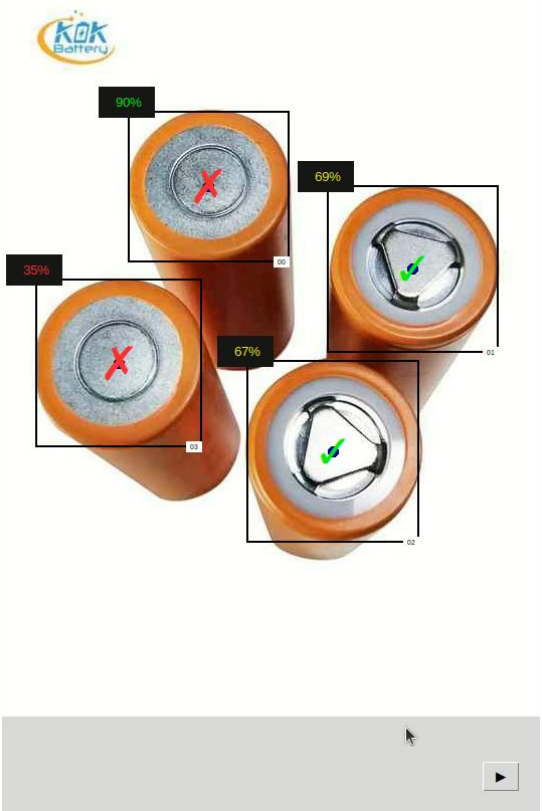
The system predict a score for the quality of the cell this will be probably based on structural damage, oxidation and other factors. A scale for battery quality has to be used



The user can edit the score assigned by the system by simply click on the scores and input a new one.

When the user think the qualities are correct they can continue



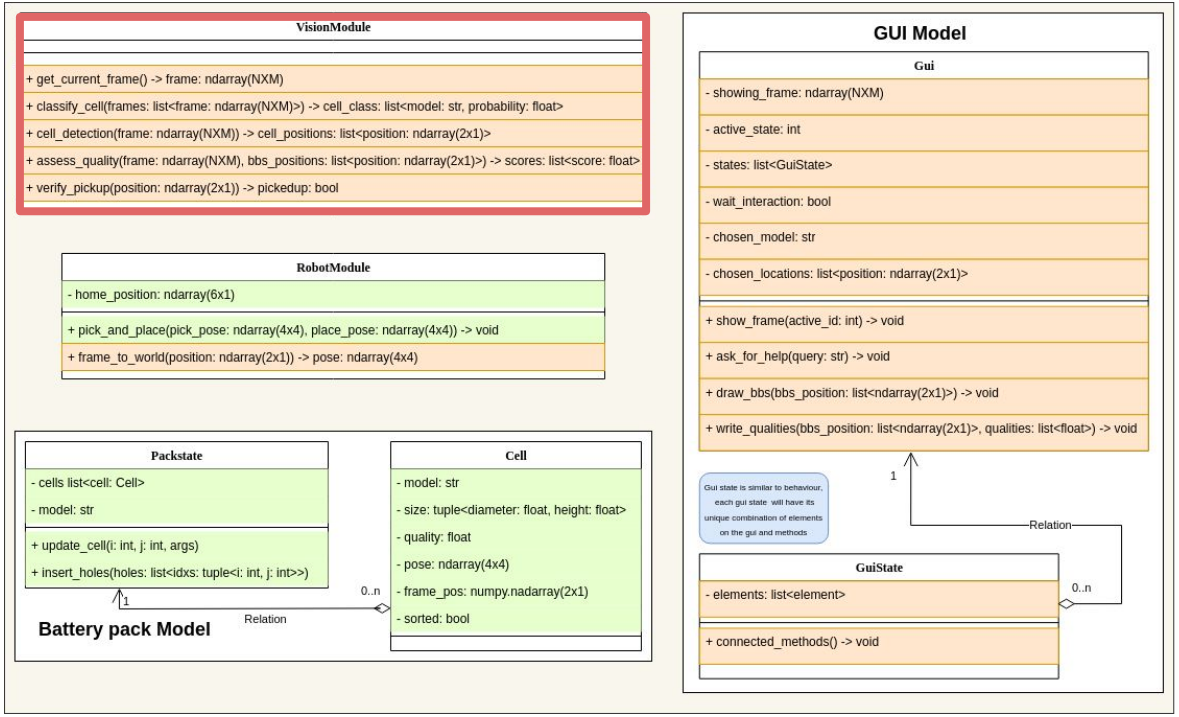


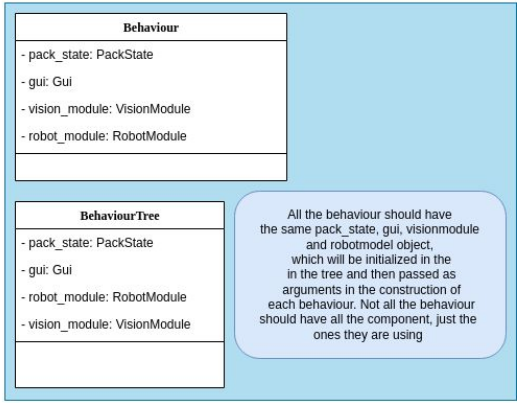
As the robot picks up the cells they are marked in the image to inform the user. At the end of the try the robot will ask the human to collect the remaining cells.

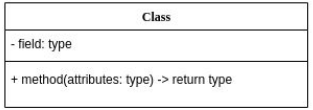
```
.
└── Battery pack/
    ├── Model:/
    │   └── XXXXX
    └── Cells:/
        ├── Cell 1/
        │   ├── Model: YYY
        │   ├── Quality: 0.87
        │   └── Pickedup: True
        ├── ...
        └── Cell N/
            ├── Model: YYY
            ├── Quality: 0.87
            └── Pickedup: True
```

A possible extension would be a tree view that inform the user of what has been defined for the battery pack and for the single battery cells. Expandable from this button and foldable when not needed

Software diagram







Vision module

Intel® RealSense™ Depth Camera D435

- Resolution of 1280 × 720
- Depth sensor
- Small size (mountable on the robot if needed)
- Easy integration with dedicated api

Classification
From height and diameter of the cell the system **could** classify the cell. It depends on the number of different cells, how much they differ and the precision of the camera

Detection
Since we have a very controlled environment deterministic methods of edge isolation and shapes detection **should** be enough. Neural network based solutions with *off-the-shelf* models could also be explored if needed

Scoring
Detection of structural damage can be paired with image analysis and machine learning to generate a score. The challenge would be to define an objective and reliable score, possibly based on the literature