M.Cimino: from performance to productivity evaluation

A paradigm shift from optimizing performances to optimizing productivity.

Metrics:

1) **non-automation** (cognitive effort)

Consider each human step of the BPMN process, described in a use case, and give a 1-to-6 score to the step, according to the cognitive taxonomy (appendix A): *remember* (1), *understand* (2), *apply* (3), *analyze* (4), *evaluate* (5), and *create* (6). Multiply the score for the # of steps of the use case, for the percentage of occurrence (in case of alternatives), and for the salary of the actor.

2) **non-responsiveness** (time)

Every begin-to-end path in the BPMN process (a scenario) is measured from time perspective, by calculating the initial and final instants; the average time is calculated over the different scenarios and multiplied by their percentage of occurrence.

3) **non-elasticity** (data load)

To feed the system with increasing no. of inputs; consider the frequency of each path; a plot of the processing time is generated, for each value of considered

inputs. Evaluate the trend (linear, quadratic, cubic, …) and motivate. A horizontal line at the value of responsiveness highlights the threshold of responsiveness.

4) **non-resiliency** (data error)

The system is tested with various types of wrong input (missing samples, late samples, unbalanced classes, ..); a 1-to-5 score is provided according to the level of management: 5- the error is not detected, 4- the error is detected and filtered, 3- the error is detected and an alert is sent, 2- the error is managed and classified, 1- the error is solved automatically. Calculate the summation of the scores.
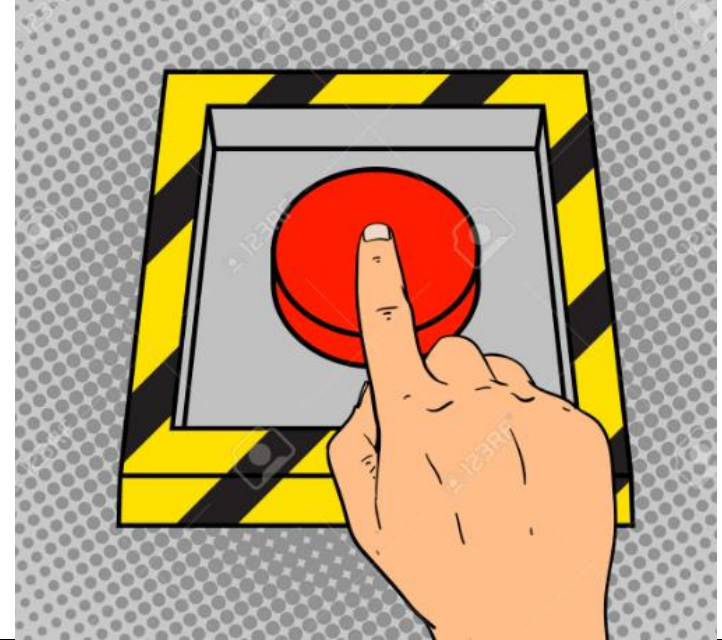
5) **non-interoperability** (non-smooth communication)

To produce the different I/O between applications and to check whether all of them are considered in the entire toolchain. Increase by one this numeric score if the application does not take into account some feature considered by the previous/next application. Compute the summation of scores.

Appendix A: cognitive taxonomy (Anderson)

1 – remember *- definition: the step can be carried out by remembering another occurrence of the same step;* - example: to press a button, to select a panel, and so on, need to remember the same step for any occurrence, or to read the manual;	
2 – understand - *the step can be carried out by finding a value in a set of predefined categories;* - example: the result of a quality check report automatically computed via two thresholds: "satisfied" in green color (1st category) or "not satisfied" in red color (2nd category, red). The human understands two possible outputs, green or red.	

QUALITY CHECK ERROR REPORT

Expert label class	Anomaly detector label class	Result
1	2	✗
2	2	✓
3	3	✓
3	1	✗
4	5	✗
3	4	✗
2	2	✓

Max number of errors tolerated (th1): 5

Max number of consecutive errors tolerated (th2): 2

Total errors: 4

Max consecutive errors: 3

th1 satisfied (4 < 5)
th2 exceeded (3 > 2)

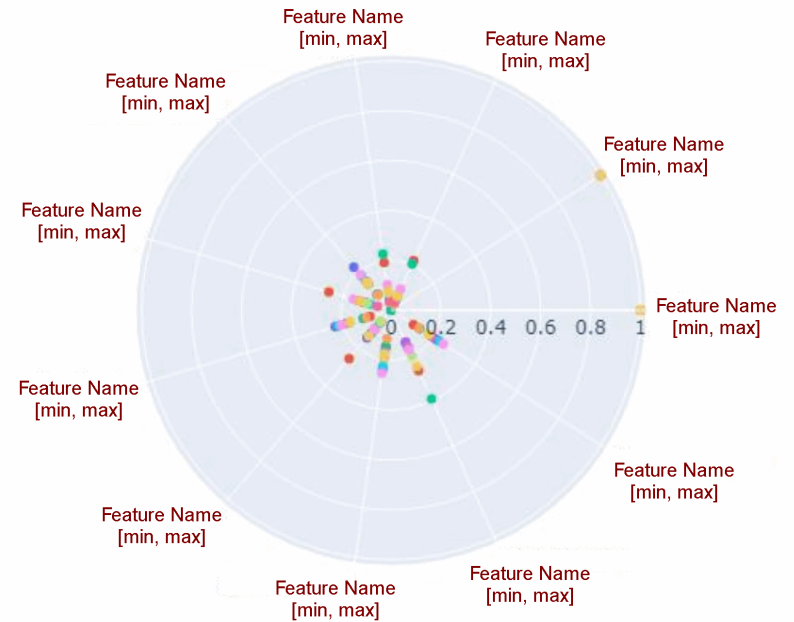|	
3 – *apply* - the step can be carried out by executing a predefined procedure, encoded by the company. - for example, to determine whether the maximum number of iterations is good or not requires a procedure, and each step is at level 3: (a) if the loss is flat for at least the half of the iterations, (a.1) then reduce by one third the number of iterations to manage overfitting; (b) if the loss is not flat at the end of the iterations, (b.1) then enlarge by one third the number of iterations; (c) otherwise, the no. of iterations is good.	MSE graph with y-axis values 2, 1.5, 1, .5 and x-axis #EPOCHS values 0, 100, 200, 300, 400
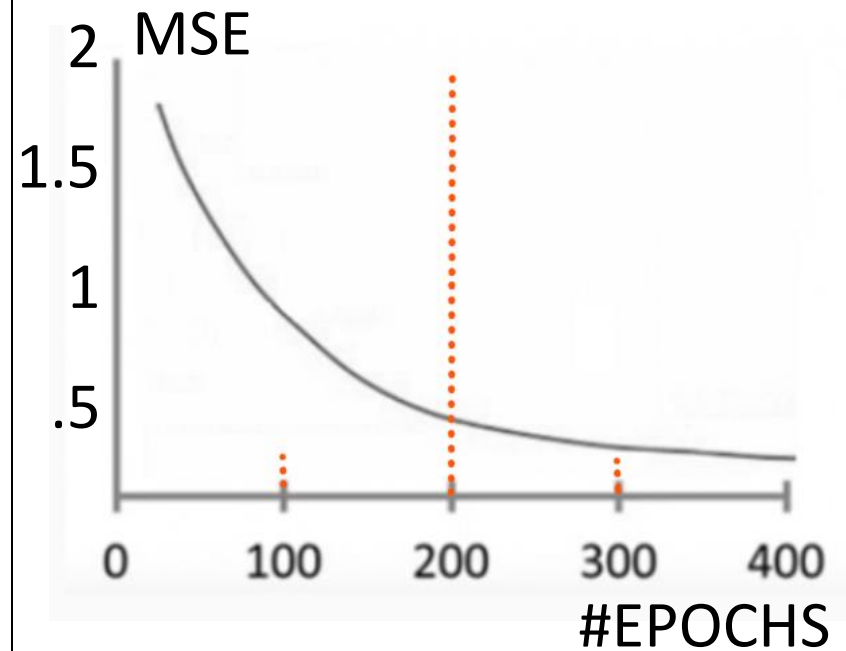
4 – *analyze* - the step can be carried out by finding unknown categories; - for example, to analyze the radar diagram for assessing the input coverage; (a) for each radius (feature) (a.1) if the distribution is not uniform as expected (a.1.1) then input coverage is not satisfied	Feature Name [min, max] (radar diagram with multiple "Feature Name [min, max]" labels and scale 0, 0.2, 0.4, 0.6, 0.8, 1)
5 – *evaluate (n.a. in this factory)*	- to detect (in-)consistencies between a product and external criteria; - to detect the appropriateness of a procedure for a given problem
6 – *create (n.a. in this factory)*	- to come up with alternative hypotheses based on criteria; - to devise a procedure for accomplishing some task, to invent a product.