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**AI-based derivation of the importance of attributes in case of evaluation models**

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# Introduction

History: The relevance/importance of attributes is a well-known phenomenon on the field of the statistics. However, these interpretations seem to be naïve (not optimized/validated) despite of statistical theories. At first, correlation-based human intuitions (c.f. the attributes with higher correlation are more important) needs at least two attributes (and none of them may be monotonous - c.f. production functions). Linearity and or mixed ceteris paribus constellations (see N [kg/ha] vs. yield [kg/ha] in case of maize with different soil-conditions) can be seen as critical aspects of the correlation-based approaches. Let alone: there are unlimited types of patterns, which can not be described with the formulas of the well-known correlations. One of the previous publications about the real impact/value of the attributes within models declared: stones = sand-elements, or even: it is possible to build diamond from CO2! It means: the importance of the attributes is a relative phenomenon. The importance of a particular attribute is depending on the set of the given attributes, because the reality seems to be very complex (each potential attribute does have a relationship with each other ones) and a real set of attributes is always a partial description of the unlimited complex reality. Therefore, it is necessary to search for more accurate approximations in this field (c.f. <https://miau.my-x.hu/miau/274/real_values_of_attributes.docx>).

Background and benchmarks: Classic production functions have always two/more realistic attributes (c.f. Y and Xi). These attributes make possible to calculate the correlation values. On the other hand, the anti-discriminative optimization (c.f. similarity analysis-based evaluation: e.g. COCO Y0 - <https://miau.my-x.hu/miau/196/My-X%20Team_A5%20fuzet_EN_jav.pdf>) does not have two real attributes, because the hypothetical Y0-variable has only a constant value – and so, correlation can not be calculated based on these raw data.

Highlighted details: If an OAM (object-attribute-matrix) is given, where the objects are e.g. human beings and the attribute are their descriptive phenomena, then it can become necessary to derive an aggregated index value (e.g. index of capability to do something by the human individuals – c.f. military actions). Based on these OAMs, anti-discriminative models can be derived, where the output is a kind of estimated index-value (see above). The question is: how may we interpret, if always one single attribute is excluded from the entire OAM and the aggregated index values will be calculated on these partial OAMs? Which kind of changes can be expected concerning the output-values (= aggregated index values)? Based on these potential changes, what kind of attributes seem to be more relevant for the evaluation (for the index-building-processes)? Finally, what is relevance/importance as such?

The results more complex than expected: The classic output version is a ranking position for each object - based on all input-attributes. Therefore, the classic output versions are in case of the reduced OAMs, similar/identical ranking values from 1 to n, where n is the number of the objects. In the basic case, not one single ranking value should be existing in two or more copies. But at least the anti-discriminative evaluation has to prove, whether all objects may have the same evaluation index-value (therefore: the same ranking value). If this scenario is given, then it is to analyse: are all potential attributes involved into the aggregated evaluation or not? In the very complex combinatorial space, attributes can be described based on a lot of specific attributes (like standard deviation among the output-values in case of a given exclusion). If the raw attributes for object evaluation lead to a new OAM, where the previous attributes (the lacks of them as scenarios) are the new objects, then the anti-discriminative modelling deliver (validated) estimation for the importance of the raw attributes (c.f. <https://miau.my-x.hu/miau/314/importance.xlsx>). More complex interpretation will be published in the full text.

Future aspects: After closing the manual-driven test-cases, the entire evaluation process can be automated e.g. in frame of development task for a bachelor's degree following the KNUTH’s principle: knowledge/science is, what can be transformed/transferred/trans-scripted into source codes – each other human activity is an artistic performance!

# Literature – background information

“*Several sets of (x, y) points, with the*[*Pearson correlation coefficient*](https://en.wikipedia.org/wiki/Pearson_correlation_coefficient)*of x and y for each set. The correlation reflects the noisiness and direction of a linear relationship (top row), but not the slope of that relationship (middle), nor many aspects of nonlinear relationships (bottom). N.B.: the figure in the center has a slope of 0 but in that case, the correlation coefficient is undefined because the variance of Y is zero*.” (See Figure Nr. 1):



Figure Nr. 1 – Anomalies of the correlation (source: <https://upload.wikimedia.org/wikipedia/commons/thumb/d/d4/Correlation_examples2.svg/600px-Correlation_examples2.svg.png>)

Based on the previous anomalies, the term of the well-known correlation is not capable of ranking relationships between variables/attributes.

The impact of the model-variables is not independent from each other. If a system (input-output-relation) has only 3 input-variables, and 1 single output-variable, then an intelligent code-breaking-tool should be able to explore the relationship between the 3 variables. Do we include a 4th variable, then the less intelligent analytical/modelling tool will try to include all 4 variables. (A more intelligent analytical tool would however try to reduce the number of the included variables – c.f. Occam’s razor). If the 4th (disturbing) variable is included into the model, then the role/impact of the original 3 variables is mostly changed (c.f. <https://miau.my-x.hu/miau/314/interdependencies.xlsx> – case study about a production-function-driven scenario-series). These changes can quasi be arbitrary (see Figure Nr.2)!

 

Figure Nr.2: Trivial detection of the unexpected relationship between variables (Legend: green cell = y-definition without x0, red cell = unexpected (<>0) influence of the given, but not needed variable of x0 / source: <https://miau.my-x.hu/miau/314/interdependencies.xlsx>)

Parallel, the impacts of the variables in model-level (e.g. sum of all partial impacts in frame of the estimations) can be changed massively on the object-levels.

A further challenge is the multiplying of similar effects (c.f. Olympic Games: scoring table - <https://miau.my-x.hu/miau/312/olimpia2024_1.xlsx> – c.f. Figure Nr.3.):



Figure Nr.3: Impact-layers (source: <https://miau.my-x.hu/miau/312/olimpia2024_1.xlsx> – Sheet “views”)

The multiple impacts (see positions in different competitions 1th - 8th), number of medals or even number of gold > silver > bronze can be seen concerning the ranking position of countries. The relativism based on population & GDP delivers arbitrary changes contrary to the performance ranking: Türkiye has following ranking positions:

* Based on the medal-hierarchy: 14th
* Based on the scores 1th - 8th: 14th
* Based on the AI-oriented relative antidiscriminative optimization: 2th

The case Hungary leads to a totally other constellation:

* Based on the medal-hierarchy: 65th
* Based on the scores 1th - 8th: 25th
* Based on the AI-oriented relative antidiscriminative optimization: 37th

The Organizers (France) could be seen as the best country concerning population and GDP vs. medal-performances:

* Based on the medal-hierarchy: 5th
* Based on the scores 1th - 8th: 3th
* Based on the AI-oriented relative antidiscriminative optimization: 1th

The case of the absolute bests (c.f. USA and China) is massive controversial: These countries are less preferable if their absolute performances are compared to the population and the GDP. Parallel, the medal-hierarchy-based winner is the USA, but China is the relative winner compared to the USA…

The Olympic-Games-based data and evaluations demonstrate a problem: the whole mankind is incapable of handling the impact and/or evaluation constellations in general and let alone in the case of the most relevant competition in the human culture (c.f. Olympic Games).

Summa summarum: there is no accepted/acceptable definition for impact/importance/relevance/evaluation of the variables (attributes) – not in model-level and let alone in object level.

Correlation is not any kind of measurable impact – not in model-level and also not in object-level. Correlation is a kind of pattern-goodness between two variables independent of the existence of other variables, even independent of the existence of the observed system (where the theoretical number of the potential variables is unlimited, or the dependencies between variables let interpret a kind of substitution alternatives.

# Own experiments

A new (better) constellation concerning the importance of the variable within a model expected a kind of KNUTH-oriented definition (it means: the definition must be transferrable into source code)!

Important is a variable in the case, where the most massive changes can be initiated based on the lack of this variable. Therefore, the system-reactions should be logged in case of the lack of each input-variable. Impact should therefore be measured based on lacks: at first on the lacks of single variables then in case of multiple variable groups: c.f. Figure Nr.4:



Figure Nr.4.: Number of combinations of variables (source: <https://en.wikipedia.org/wiki/Combination>)

The text-version of “most changes” is a typical human-intuition-driven text-version of the magic of the words. Human beings can work with such fuzzy instructions, but it is not KNUTH-oriented enough.

Changes can be interpreted in quasi unlimited ways (c.f. variables/impact-mechanisms in a system), therefore, it is irrelevant, whether we do have a list of them or not. Relevant is, that we should be capable of integrating all potential changes (attributes/variables). In this case, we need to build an OAM from all thinkable differences (c.f. case study about the objective evaluation of the Olympic Games) between the model-outputs based on ALL variables and the model-outputs based always on the partial OAM (where each particular attribute is excluded – in a version always only one single attribute).

This publication is not only focused on the production-function-driven impacts, but also on the aimlessness (see anti-discriminative optimization without a real output variable) being more complex from mathematical point of view. Therefore, the above defined output-comparison can/must be used for all these cases. Model-outputs can always be derived. The most relevant question is: what types of model-outputs can be existing at all?

# Types of model-outputs

Details: <https://miau.my-x.hu/miau/314/importance.xlsx>, <https://miau.my-x.hu/miau/314/importance_2.xlsx>

In the reality, factual model-outputs in case of production-function-driven OAMs for the particular objects (cases, scenarios, constellations) are mostly different from each other. Therefore, the estimated model-outputs lead to the quasi same differentiated approach. It seems to be not a massive problem, if some values (between the facts and/or between the estimations) are the same. The Pearson-correlation is also a kind a combinatorics-oriented approach to measure similarities between ranking value-series.

On the other hand, the anti-discriminative modelling can lead (should at least be capable of leading) to massive sameness between the estimated output-values, because the hypothesis as such tries to derive the output-sameness for all objects.

The anti-discriminative modelling does even deliver the same output-values (c.f. Figure Nr.5), if this is possible based on a part of the offered attributes (c.f. specific approach of the Occam’s-razor-logic). So, the question is simple: which interpretation system (hermeneutics) is necessary to handle the arbitrary sameness-constellations?



Figure Nr.5: Massive existence of norm-values in an evaluation (source: <https://miau.my-x.hu/miau/314/importance.xlsx> - Sheet: “15\*33”)

The most extreme output-constellation would be, where the benchmark model with ALL variables and the partial models (excluding always one input-variable) could lead to the total sameness of the output-values. In this case (always being focused on the real objective of the evaluation), each variable has the same importance, because no differences can be identified in the model-outputs. (In the case of the total sameness of the output-values, there are no possibilities to calculate e.g. correlation values…)

A parallel existing challenge is the existence of antagonisms between objects (see Figure Nr.6): e.g. how important is a variable, if the lack of this variable and the lack of an other one lead to two objects (log-constellations about the changes of the model-outputs) having irrational relationship to each other (one of the objects has log-data never more irrelevant than in case of the other objects (where each log shows less change concerning each observed output-changes compared to the benchmark with all attributes).

 

Figure Nr.6: Antagonisms (source: <https://miau.my-x.hu/miau/314/importance_2.xlsx> – Sheet “5”)

This problem is already well-known: the public procurement decisions are quasi always influenced by corrupted relationships (like hired illusions: where offers are faked with less relevant performance profiles and yet higher prices). These antagonistic situations can be interpreted if only the winner of a public procurement action should be derived, but the importance/relevance/impact of the attributes concerning the aggregated evaluation values needs ranking positions for ALL attributes (compared to each other).

# Discussions and conclusions

The sameness-problem can be seen as a kind of effectless force field and each effectless variable group delivers scores to the aggregated evaluation of the output-changes based on the lack of the unique variables (c.f. Figure Nr.7):



Figure Nr.7: Effects of lacks concerning variables source: <https://miau.my-x.hu/miau/314/importance.xlsx> - Sheet: “effectless”)

The interpretation of the sameness-driven constellations can be derived in a lot of arbitrary ways (c.f. Figure Nr.8).



Figure Nr.8: Comparison of two evaluation ways (Source: <https://miau.my-x.hu/miau/314/importance.xlsx> - Sheet: “15\*33”) Legend: blue-signs highlights the probably most relevant variables identified in Figure Nr.3. – but the relative correlation values and relative standard deviation values as aggregation force fields lead to a totally other impact ranking…

The arbitrariness can be analysed (c.f. Figure Nr.9):



Figure Nr.9: Detection of irrational comparison effects (source: <https://miau.my-x.hu/miau/314/importance.xlsx> - Sheet: “15\*33”) Legend: blue-signs highlights the probably most relevant variables identified in Figure Nr.3. – but the relative correlation values and relative standard deviation values as aggregation force fields lead to a totally other impact ranking…

The real question is: is there any theoretical aspects to increase the level of the objectivity? The answer is simple: the number of the effectless constellations and the correlation-based partial changes (effects) can be handled in an aggregated form based on anti-discriminative modelling.

The problem of the antagonisms can be solved in a lot of arbitrary ways. The real question is like before: is there any theoretical aspects to increase the level of the objectivity? The answer is more complex as in case of the sameness problems: the antagonisms can be interpreted as a kind of problem in the validation and all phenomena having invalidity signs, can be excluded from the evaluation process. OR these invalidity signs can be process like the force fields above.

The seemingly side-effect-like presentation of the evaluation results concerning the Olympic Games demonstrates (c.f. Figure Nr.1. and the whole analysis behind this Figure): OAMs with massive amount of antagonisms (c.f. performances of countries) can be interpreted compared to each other to make more sensitive the best objects, because the performances of the countries can not be evaluated as corrupted constellations. On the other hand (c.f. Figure Nr.4. and the entire process about this highlighted detail), the antagonisms can reduce the expression of the searched variable-impacts.

The amount and structure of the raw data is also important to make the whole analytical process more sensitive.

The exploring of impacts of variables based on the lack-oriented approach can be seen as a brute-force (combinatorial) problem: which k variables (from n raw attributes) deliver the most similar outputs where the similarity means: the reducing the number of the raw attributes leads to more or less output/conclusion-changes as a kind of risk but the whole reduction causes less costs/time-consumption (c.f. data collection, data handling, data archiving, data protection). The comparison of these negative and positive details can be managed based on the already mentioned anti-discriminative optimization (e.g. COCO Y0: <https://miau.my-x.hu/myx-free/index_en.php3>).

This publication does not integrate the whole complexity of the validation layers into the interpretation universe of the focused challenge…

# References

…see in the text stream…