TOWARDS AN ECO-SCORE FOR FASHION: HOW AI CAN TRANSFORM THE WAY WE BUY CLOTHES?

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270, that is a shocking figure! That is the number of kilos of CO_2 emitted per person per year in Europe just through the purchase of clothes. Quite a lot, isn't it? The textile industry alone is responsible for 10% of the world's CO_2 emissions, mainly because of the boom in ultra-fast fashion. It is hardly surprising, then, that the textile industry is also concerned with the issue of sustainability. It is against this backdrop that the idea of a textile eco-score, similar to the Nutri-Score in the food sector, has been developing over the last few years. Like the Nutri-Score, the textile eco-score would enable consumers, whether or not they are concerned about sustainability issues, to buy with an understanding of the environmental impact of their choices. A clear, quick indicator for assessing the sustainability of their purchases could encourage them to take the first step towards changing their habits and opting for more responsible options.

At present, few labels consider the environmental impact of textiles throughout their life cycle because too much data is needed to make this assessment. This is essential to guarantee the accuracy of such an analysis. LCA, or "life-cycle assessment," is a widely recognized method for assessing this impact throughout the life of a product. It considers all the environmental impacts, from the extraction of the raw materials, through the manufacture, distribution, and use of the product, to the management of its end-of-life. Despite its accuracy, however, the LCA has a number of drawbacks: it is complex, time-consuming, costly, and, above all, difficult to use to quickly assign an overall sustainability score.

To overcome these challenges, current machine learning techniques offer a promising avenue. Machine learning is a field of artificial intelligence in which algorithms - descriptions of sequences of steps used to obtain results from input elements - learn autonomously to perform tasks or make predictions based on data. Using machine learning to automatically assess the durability of products has not yet been tested for clothing, particularly in the specific context of online retailing, where little data is

available to sellers. The aim of this research is to develop a data classification algorithm capable of predicting the level of durability of any new product. This involves building a data set in several stages:

Stage 1: Selection of product characteristics that are both relevant and available to online retailers, and that have the greatest environmental impact. Each element of the textile supply chain has an impact: raw material, transformation process, place of manufacture, transport, maintenance, and end-of-life management of the garment. Determining the relevant characteristics for the algorithm means grouping them according to life cycle phases while ensuring that they cover the entire life cycle.

Stage 2: Collection of garments already assessed using LCA.

Stage 3: Definition of an output variable via a single score, facilitating communication and comparison between products. To do this, the authors need to define the environmental indicators that will make up this variable, such as energy, water, chemicals used, waste, carbon emissions from production, and the environmental costs of transport. These factors will then have to be aggregated, which is the challenge of this research. Life cycle data need to be standardized and weighted to reflect the overall impact.

With these foundations in place, nine supervised machine learning tools were tested to classify clothing according to its level of sustainability, on a five-level scale ranging from XS (extra sustainable) to XNS (extra non-sustainable). The results are evaluated based on products whose impact is known, without having been used to train the tools. Most of the classification errors relate to NS and XNS, with one being used for the other and vice versa. Since the aim is to identify sustainable products, this error is not problematic, since the product is correctly labeled as non-sustainable overall.

The 'random forest' algorithmic machine learning model proved to be the most appropriate, both for the data and for the objective of this research. Presented in the form of a forest of decision trees, hence its name, it makes it possible to extrapolate the results of a life-cycle assessment, making correct predictions about the level of sustainability of new garments, thereby avoiding a costly and time-consuming procedure.

Ultimately, this research will make it possible to provide rapid environmental feedback on a wide variety of garments, despite the limited data available to online retailers and consumers in general. This model could therefore serve as the basis for the development of a single, simple, and intuitive environmental label, similar to the Nutri-Score or energy labels. This type of label is clear for consumers, who can then determine which products to avoid or prefer according to their personal convictions.

> **This research lays the foundations for more environmentally friendly fashion, enabling everyone to contribute in their own way to the efforts needed to preserve the future of our planet. So, when you make your next purchase, what will your score be?**