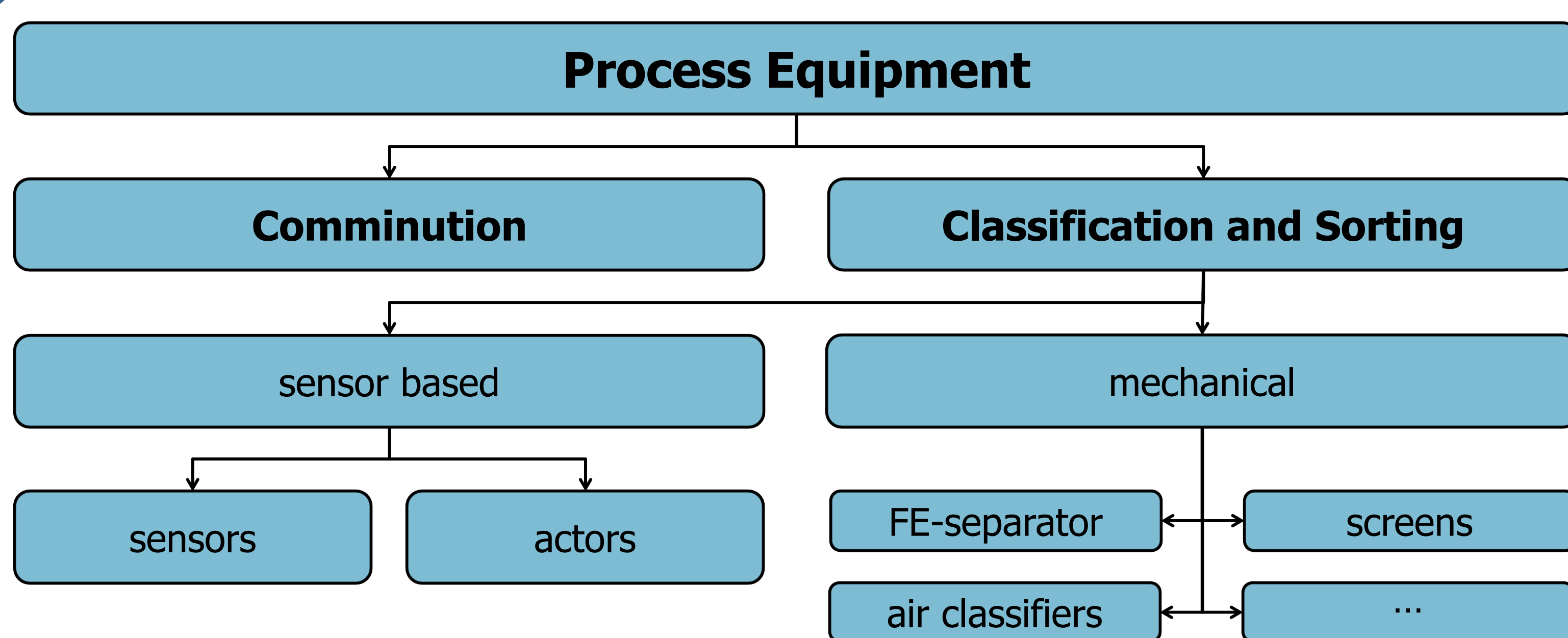
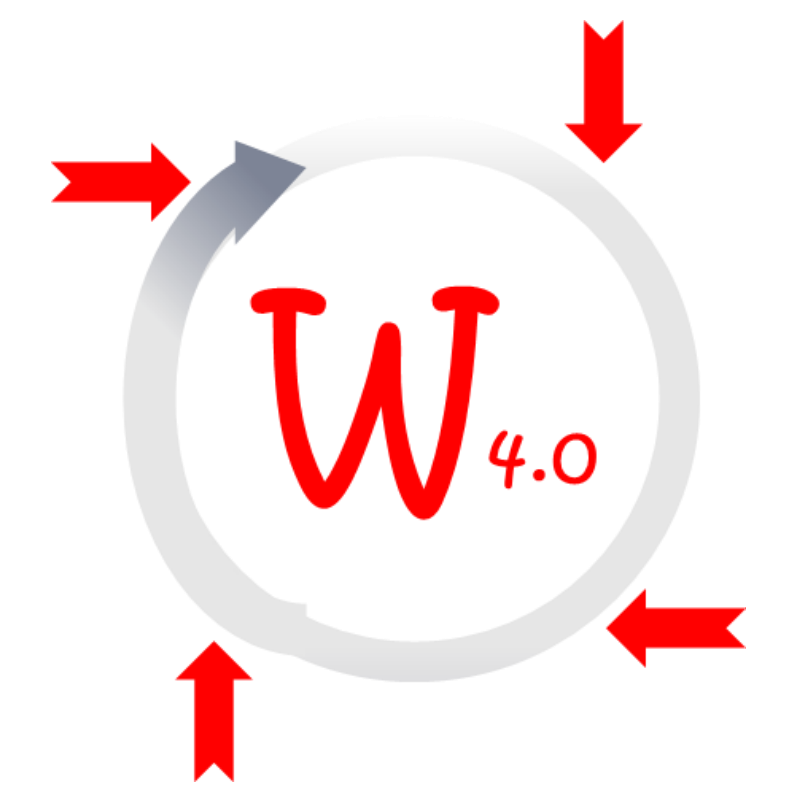


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Recycling and Recovery of Waste 4.0 is a COMET programme, dealing with the application of industry 4.0 approaches like digital networking and material-machine-communication on the mechanical processing of municipal solid waste (MSW). Challenges treated in the project include online/on-time-classification of the plant's input and output, as well as considering new opportunities for valuables contained in the waste and strategies for the handling of contaminants. Further, process approaches for future smart waste factories are designed, taking in consideration the development of the necessary process equipment.



Process Equipment describes the machines, performing the different unit operations in mechanical MSW processing. Usually the first step is comminution, performed by a coarse shredder. It is followed by a number of classification and sorting steps, implemented through screens, air classifiers, ballistic separators, magnetic separators, eddy current separators or sensor based sorters. This allows to obtain a number of recyclable fractions.

Challenges ...

- Efficiently optimising the performance of a high variability of machines
- Defining the key influence factors on machine performance for the development of controllable actuators
- Providing target values for the control of a process with extremely instationary input material composition
- Modelling material-material and material-machine interactions
- Dealing with the inhomogeneity of waste compositions

... and Approaches in Plant Automation

- Screening experiments for determining key influence factors
- Statistical models for sorting efficiencies dependent on process- and machine-parameters as well as waste composition
- Live modelling of process optima for providing target values
- Description of waste compositions through multivariate probability density functions (Figure 1) and log-ratio transformations for compositional data

Summary and Outlook

Handling the high variability of process equipment and the difficulties of MSW regarding physical describability as well as variability led to the approach of process optimisation through live modelling of control target values, using statistical correlations rather than profound physical models. A hypothesis regarding the choice of the necessary mathematical tools was defined. Lab scale experiments with well defined model materials are actually performed to test the hypothesis. As soon as they succeed, the application on real machines and wastes is planned for a choice of process equipment.

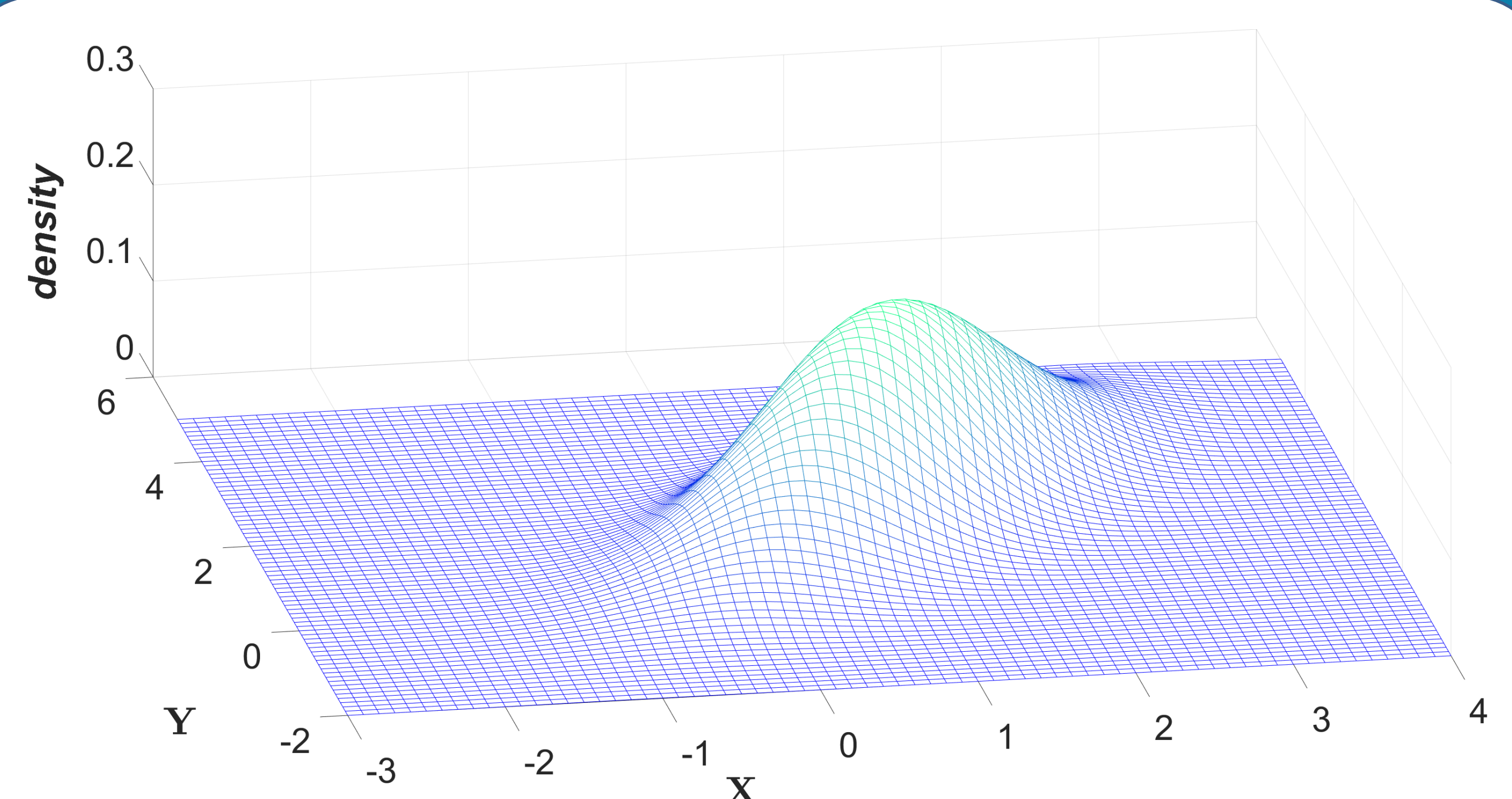


Figure 1: Bivariate normal distribution – an example of a multivariate probability density function

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