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The Role of Theory and Data in Model Building: from Richardson to machine learning

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The talk is devoted to a discussion of different typologies of models:

- I- Oversimplified models;
- II- Models by analogy;
- III- Large scale models;
- IV- Models from data.

In the class I there is the celebrated Lorenz model; the Lotka-Volterra system is in the class II, and it is at the origin of biomathematics.

Among the models in the class III we have the effective equations used, e.g., in meteorology and engineering, where only "relevant variables" are taken into account.

In the class IV we find the most interesting (and difficult) problem: the building of models just from data without a reference theoretical framework.