PUBBLICAZIONE DELLE TRACCE DELLA PROVA SCRITTA

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Prova scritta estratta

Traccia B
Scenario. – Machine Learning methods can be applied within several scenarios in astronomy/astrophysics/cosmology. Describe one such scenario and motivate the use of ML techniques by pointing to the advantages over other statistical analysis methods if possible.
Research question – Formulate a precise research question related to the chosen scenario.
Task – Discuss the design of a data analytics study for the investigation of the research question. For the sake of illustration:

- describe the kind of data that are assumed to be available, in terms of attributes/features, quantity/size and quality
- specify the Machine Learning tasks that could be involved in the study (e.g. representation learning, anomaly detection, classification, regression);
- specify the performance metrics relevant to the problem;
- if possible, identify and contrast two families of algorithms that could implement the tasks;
    - describe very synthetically their principle of operation;
    - highlight similarities and differences among the algorithms e.g. in terms of metrics other than prediction performance, such as
        - easiness of implementation/deployment, off-the-shelf availability,
        - interpretability of the learned model,
        - computational cost;
- based on the above elements motivate the choice of the algorithms
- describe an experimental pipeline that could support the investigation and, if applicable, point to software libraries that would be appropriate for the deployment

Tracce non estratte

Traccia A
Scenario. – Describe and motivate a scenario of interest in astronomy/astrophysics/cosmology that could benefit from the application of Machine Learning methods, and if applicable discuss briefly the advantages over other statistical analysis methods. Describe the kind of data that are assumed to be available, in terms of attributes/features, quantity/size and quality.
Research question – State a precise research question related to the scenario.
Task – Discuss the design of a data analytics study for the investigation of the research question. For the sake of illustration:

- specify the Machine Learning tasks that could be involved in the study (e.g. representation learning, classification, regression);
- specify the target performance metrics relevant to the problem;
- if possible, identify and contrast two families of algorithms that could implement the tasks;
    - describe very synthetically their principle of operation;
    - highlight similarities and differences among the algorithms e.g. in terms of metrics such as
        - easiness of implementation

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  - off-the-shelf availability (if applicable point to software libraries that would be appropriate for the deployment),
  - interpretability,
  - computational cost;
- based on the above elements motivate the choice of the algorithms
- describe an experimental pipeline that could support the investigation
- outline the expected results and criticalities

Traccia C

Scenario. – Astronomy, astrophysics and cosmology offer a number of scenarios where the use of Machine Learning can provide advantages over more traditional statistical analysis methods. Describe one scenario of interest.
Research question – Formulate a precise research question related to the chosen scenario.
Task – Discuss the design of a data analytics study for the investigation of the research question. For the sake of illustration:

- describe the kind of data that are assumed to be available
  - briefly describe the source and the quality of the data
  - point to the salient attributes/features,
  - state the assumed size of the dataset
- specify the Machine Learning tasks that could be involved in the study (e.g. regression, classification, anomaly detection, representation learning, sequence translation, forecasting, association rule discovery, pattern mining etc.);
- specify the performance metrics relevant to the problem;
- if possible, identify and contrast two families of algorithms that could implement the tasks;
  - describe very synthetically their principle of operation;
  - highlight similarities and differences among the algorithms e.g. in terms of metrics other than prediction performance, such as
    - computational cost
    - interpretability of the learned model
    - off-the-shelf availability, easiness of implementation/deployment
- motivate the choice of the algorithms based on the above elements
- describe an experimental pipeline that could support the investigation and, if applicable, point to software libraries that would be appropriate for the deployment
- outline the expected results and criticalities.

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