

UNIVERSITÀ DEGLI STUDI DI
MILANO-BICOCCA

ADVANCED MACHINE LEARNING
PROGETTO FINALE

Overfitting

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Sommario

The ABSTRACT is not a part of the body of the report itself. Rather, the abstract is a brief summary of the report contents that is often separately circulated so potential readers can decide whether to read the report. The abstract should very concisely summarize the whole report: why it was written, what was discovered or developed, and what is claimed to be the significance of the effort. The abstract does not include figures or tables, and only the most significant numerical values or results should be given.

1 Introduzione

L'obiettivo del progetto è quello di costruire un modello di machine learning per la classificazione di immagini in grado di operare bene su un dataset di piccole dimensioni comprendente un alto numero di classi simili tra di loro. Come è facilmente intuibile, il problema principale di operare su un dataset di questo tipo è l'overfitting del modello sui dati di training con conseguente fallimento del modello su dati nuovi. Per risolvere questo problema ci siamo concentrati sulla ricerca di modelli, iperparametri e tecniche di generalizzazione che permettessero al modello di essere in grado di operare su un dataset di test molto più ampio di quello utilizzato per l'addestramento. Il modello utilizzato per questo tipo di analisi è una rete neurale convoluzionale; questo tipo di modello si è dimostrato negli ultimi anni il migliore nel classificare immagini in moltissimi campi di applicazione.

The introduction should provide a clear statement of the problem posed by the project, and why the problem is of interest. It should reflect the scenario, if available. If needed, the introduction also needs to present background information so that the reader can understand the significance of the problem. A brief summary of the hypotheses and the approach your group used to solve the problem should be given, possibly also including a concise introduction to theory or concepts used later to analyze and to discuss the results.

2 Dataset

Il dataset utilizzato è il *102 Category Flower Dataset* creato dai ricercatori del *Visual Geometry Group* di *Oxford*. Il dataset è composto da 8189 immagini

RGB di dimensione variabile, ogni immagine contiene uno o più fiori su sfondo neutro ed è etichettata con una singola categoria da un insieme di centodieci categorie. E' stata mantenuta la suddivisione del dataset definita nella pubblicazione originale, in particolare si hanno:

- 1020 immagini nel training set
- 1020 immagini nel validation set
- 6149 immagini nel test set

Ogni categoria è rappresentata da 10 immagini nel training set e nel validation set, mentre la proporzione di immagini per ogni categoria varia nel test set. La difficoltà di operare su un dataset di questo tipo è evidente, il numero di immagini è limitato mentre il test set è ampio.

In this section the available data sets must be presented. The term dataset refers to any type of information source, for example web services for geolocation fall into this category. In addition, all necessary data manipulation processes, such as cleaning and enrichment with external sources, must be presented and discussed.

3 The Methodological Approach

This is the central and most important section of the report. Its objective must be to show, with linearity and clarity, the steps that have led to the definition of a decision model. The description of the working hypotheses, confirmed or denied, can be found in this section together with the description of the subsequent refining processes of the models. Comparisons between different models (e.g. heuristics vs. optimal models) in terms of quality of solutions, their explainability and execution times are welcome.

Do not attempt to describe all the code in the system, and do not include large pieces of code in this section, use pseudo-code where necessary. Complete source code should be provided separately (in Appendixes, as separated material or as a link to an on-line repo). Instead pick out and describe just the pieces of code which, for example:

- are especially critical to the operation of the system;
- you feel might be of particular interest to the reader for some reason;

- illustrate a non-standard or innovative way of implementing an algorithm, data structure, etc..

You should also mention any unforeseen problems you encountered when implementing the system and how and to what extent you overcame them. Common problems are: difficulties involving existing software.

4 Results and Evaluation

The Results section is dedicated to presenting the actual results (i.e. measured and calculated quantities), not to discussing their meaning or interpretation. The results should be summarized using appropriate Tables and Figures (graphs or schematics). Every Figure and Table should have a legend that describes concisely what is contained or shown. Figure legends go below the figure, table legends above the table. Throughout the report, but especially in this section, pay attention to reporting numbers with an appropriate number of significant figures.

5 Discussion

The discussion section aims at interpreting the results in light of the project's objectives. The most important goal of this section is to interpret the results so that the reader is informed of the insight or answers that the results provide. This section should also present an evaluation of the particular approach taken by the group. For example: Based on the results, how could the experimental procedure be improved? What additional, future work may be warranted? What recommendations can be drawn?

6 Conclusions

Conclusions should summarize the central points made in the Discussion section, reinforcing for the reader the value and implications of the work. If the results were not definitive, specific future work that may be needed can be (briefly) described. The conclusions should never contain "surprises". Therefore, any conclusions should be based on observations and data already discussed. It is considered extremely bad form to introduce new data in the conclusions.

References

The references section should contain complete citations following standard form. The references should be numbered and listed in the order they were cited in the body of the report. In the text of the report, a particular reference can be cited by using a numerical number in brackets as [?] that corresponds to its number in the reference list. L^AT_EX provides several styles to format the references