Basic recipe for a deep learning project

Everybody can bake a cookie

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Basic recipe

1. Define a metric
2. Define a target
3. Prepare your data
4. Do good on train set
5. Do good on val/test sets

1) Have a single metric

- Crossentropy is usually a good choice for loss
  - But real application care more about errors/accuracy
- [P] Precision = (True Positives) / (All Positives)
  - E.g. precision is 95% and you say “sick” → there’s a 95% chance the patient is actually sick
- [R] Recall (TPR) = (True Positives) / (True Positive + False Negatives)
  - E.g. recall is 95% → you have found 95% of the sick patients
- Tradeoff
- F1 = 2 * (P * R) / (P + R)
  - “Harmonic average”
  - F2 for recall, F0.5 for precision

1b) or a “single” metric

- Multiple metrics happen
- Have N metrics:
  - Pick one to be optimizing
  - N-1 will be satisficing

Time	Error rate

2) Human level target

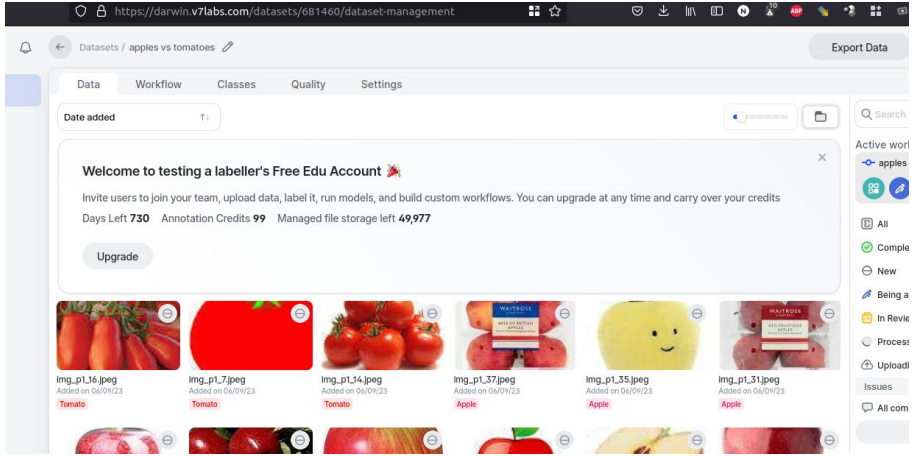
- “True” target: Bayes error rate
  - The lowest possible error rate, by definition
  - Unknowable :(
- Human expert(s) error rate
  - Good proxy on well known topics
  - Hard to get by (sometimes)
- State of the art classifiers
  - Maybe good proxy? Maybe not
  - Easy to get by

3) Prepare your data

- Label your data
- Normalize
- Preprocess (resize, feature extraction...)
- Train/val/test sets
  - They MUST come from the same distribution
- Unbalancedness
- Missing data imputation

3bis) Tools for data labelling

- Speed up classification, segmentation
- Compare different human-assigned labels
- Usually free for small datasets
- Many alternatives available
  - https://V7labs.com
  - https://labelbox.com
  - https://superannotate.com/



4) Do good on the train set

- More epochs
  - Different runs
- Optimizer
- Crossvalidate hyperparam choice
  - Learning rate, #/layers, #units, THEN everything else
  - greedy stepwise model selection [Nazzicari & Biscarini, 2022], kerasTuner, etc.
- More data
- Bigger network
- Error analysis
- Restate the problem (e.g. decomposition)

5) Do good on the test set

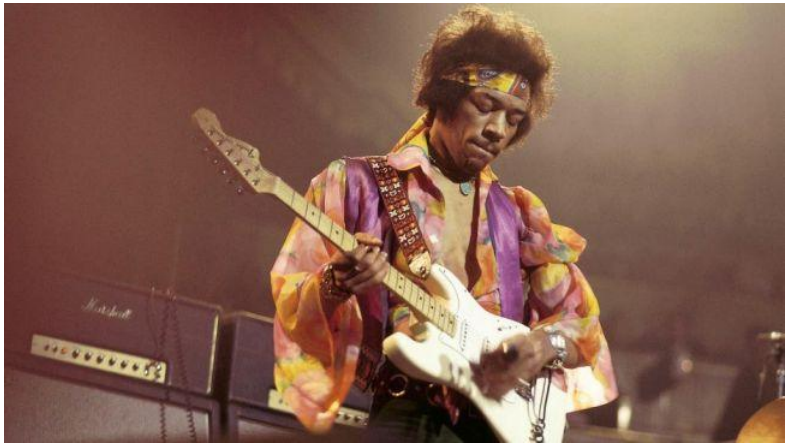
- Overfitting?
- Errors in dataset?
- Regularization

Error analysis: False positives

Error analysis: False negatives

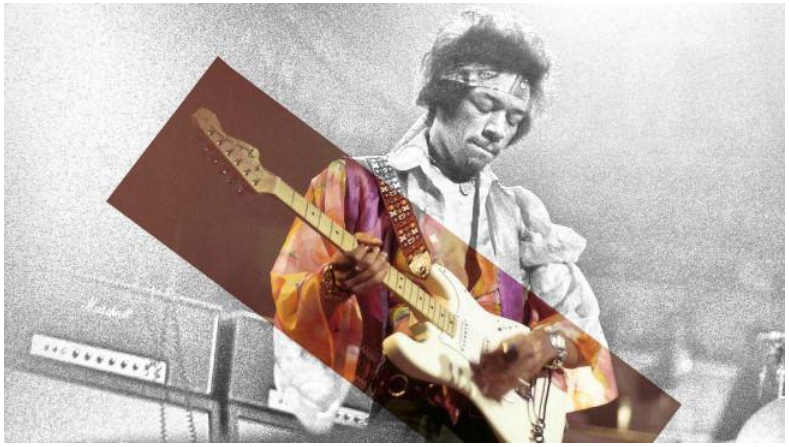
Problem decomposition

Classify the instrument



Find the instrument

Classify the instrument



Computation resources

- Google Colab
  - https://colab.research.google.com/
  - Remember to change runtime type
  - Factory reset is your friend
- Kaggle Notebooks (and datasets)
  - https://www.kaggle.com/notebooks
  - A phone number is required
  - Very fun (read: very stressing) competitions
- Binder
  - https://mybinder.org/
  - “Turn a Git repo into a collection of interactive notebooks”
  - A little waiting time
  - Learn about requirements.txt