XGBoost

dataworkshop.eu

Alekseichenko Vladimir

Disclaimer

Data Workshop *[all time]* focuses on the **intuition** and **practical** tips.

For a formal treatment, see something else.*

* papers or classical machine learning books

Workshop Program

Wednsday, September 29

08:45 – 09:00 ○ **Opening**

09:00 – 10:30 ● **Workshop - part I**

Vladimir Alekseichenko

Introduction
Understand business and data
Overivew: decision tree, boosting, gradient boosting

10:30 – 11:00 ● **Coffee break**

11:00 – 12:30 ● **Workshop - part II**

Vladimir Alekseichenko

Simple model
Feature enginnering
Incremental learning

12:15 – 12:30 ○ **Summary**

Motivation

why boosting?

Motivation

XGboost is utilized

in many **winning** solutions.

XGBoost

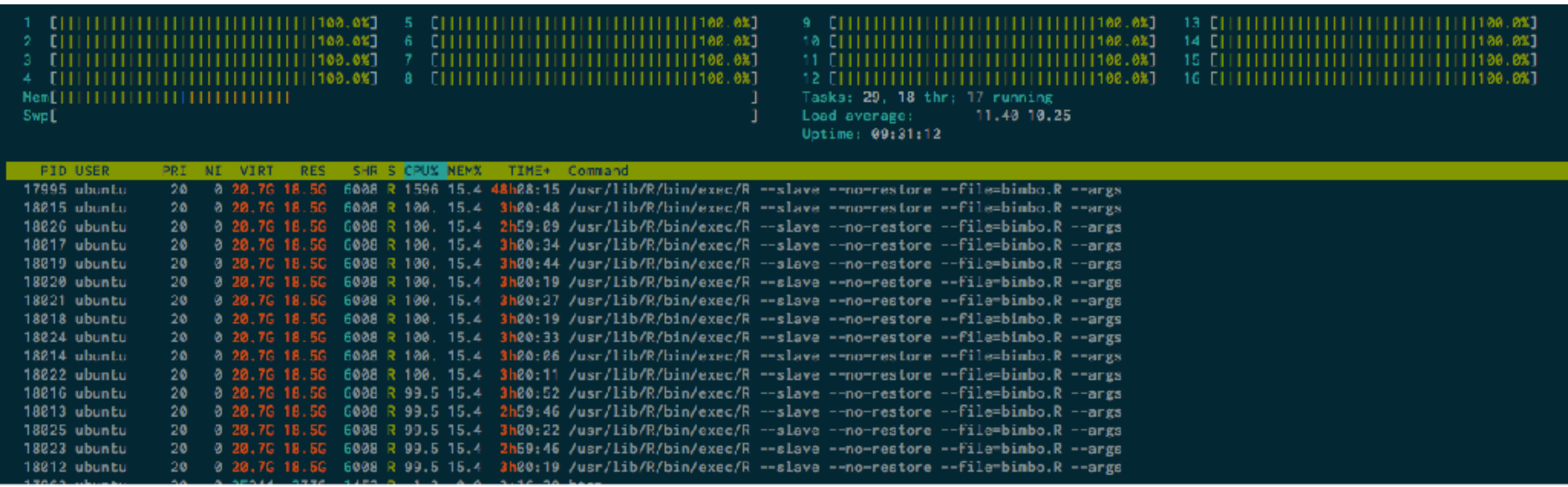
(eXtreme Gradient Boosting)

"When in doubt, use xgboost"

Owen Zhang

OWEN'S PROFILE ON KAGGLE

16 cores



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Load average: 11.40 10.25
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PID USER PRI NI VIRT RES SHR S CPU% MEM% TIME+ Command
17995 ubuntu 20 0 20.7G 18.5G 6008 R 1596 15.4 48h28:15 /usr/lib/R/bin/exec/R --slave --no-restore --file=bimbo.R --args
18015 ubuntu 20 0 20.7G 18.5G 6008 R 100. 15.4 3h20:48 /usr/lib/R/bin/exec/R --slave --no-restore --file=bimbo.R --args
18026 ubuntu 20 0 20.7G 18.5G 6008 R 100. 15.4 2h59:09 /usr/lib/R/bin/exec/R --slave --no-restore --file=bimbo.R --args
18017 ubuntu 20 0 20.7G 18.5G 6008 R 100. 15.4 3h20:34 /usr/lib/R/bin/exec/R --slave --no-restore --file=bimbo.R --args
18019 ubuntu 20 0 20.7G 18.5G 6008 R 100. 15.4 3h20:44 /usr/lib/R/bin/exec/R --slave --no-restore --file=bimbo.R --args
18020 ubuntu 20 0 20.7G 18.5G 6008 R 100. 15.4 3h20:19 /usr/lib/R/bin/exec/R --slave --no-restore --file=bimbo.R --args
18021 ubuntu 20 0 20.7G 18.5G 6008 R 100. 15.4 3h20:27 /usr/lib/R/bin/exec/R --slave --no-restore --file=bimbo.R --args
18018 ubuntu 20 0 20.7G 18.5G 6008 R 100. 15.4 3h20:19 /usr/lib/R/bin/exec/R --slave --no-restore --file=bimbo.R --args
18024 ubuntu 20 0 20.7G 18.5G 6008 R 100. 15.4 3h20:33 /usr/lib/R/bin/exec/R --slave --no-restore --file=bimbo.R --args
18014 ubuntu 20 0 20.7G 18.5G 6008 R 100. 15.4 3h20:26 /usr/lib/R/bin/exec/R --slave --no-restore --file=bimbo.R --args
18022 ubuntu 20 0 20.7G 18.5G 6008 R 100. 15.4 3h20:11 /usr/lib/R/bin/exec/R --slave --no-restore --file=bimbo.R --args
18016 ubuntu 20 0 20.7G 18.5G 6008 R 99.5 15.4 3h20:52 /usr/lib/R/bin/exec/R --slave --no-restore --file=bimbo.R --args
18013 ubuntu 20 0 20.7G 18.5G 6008 R 99.5 15.4 2h59:46 /usr/lib/R/bin/exec/R --slave --no-restore --file=bimbo.R --args
18025 ubuntu 20 0 20.7G 18.5G 6008 R 99.5 15.4 3h20:22 /usr/lib/R/bin/exec/R --slave --no-restore --file=bimbo.R --args
18023 ubuntu 20 0 20.7G 18.5G 6008 R 99.5 15.4 2h59:46 /usr/lib/R/bin/exec/R --slave --no-restore --file=bimbo.R --args
18012 ubuntu 20 0 20.7G 18.5G 6008 R 99.5 15.4 3h20:19 /usr/lib/R/bin/exec/R --slave --no-restore --file=bimbo.R --args

Are you ready?

github.com/dataworkshop/whyr_xgboost

Allstate®
You're in good hands.

kaggle™

Claims Severity

kaggle.com/c/allstate-claims-severity

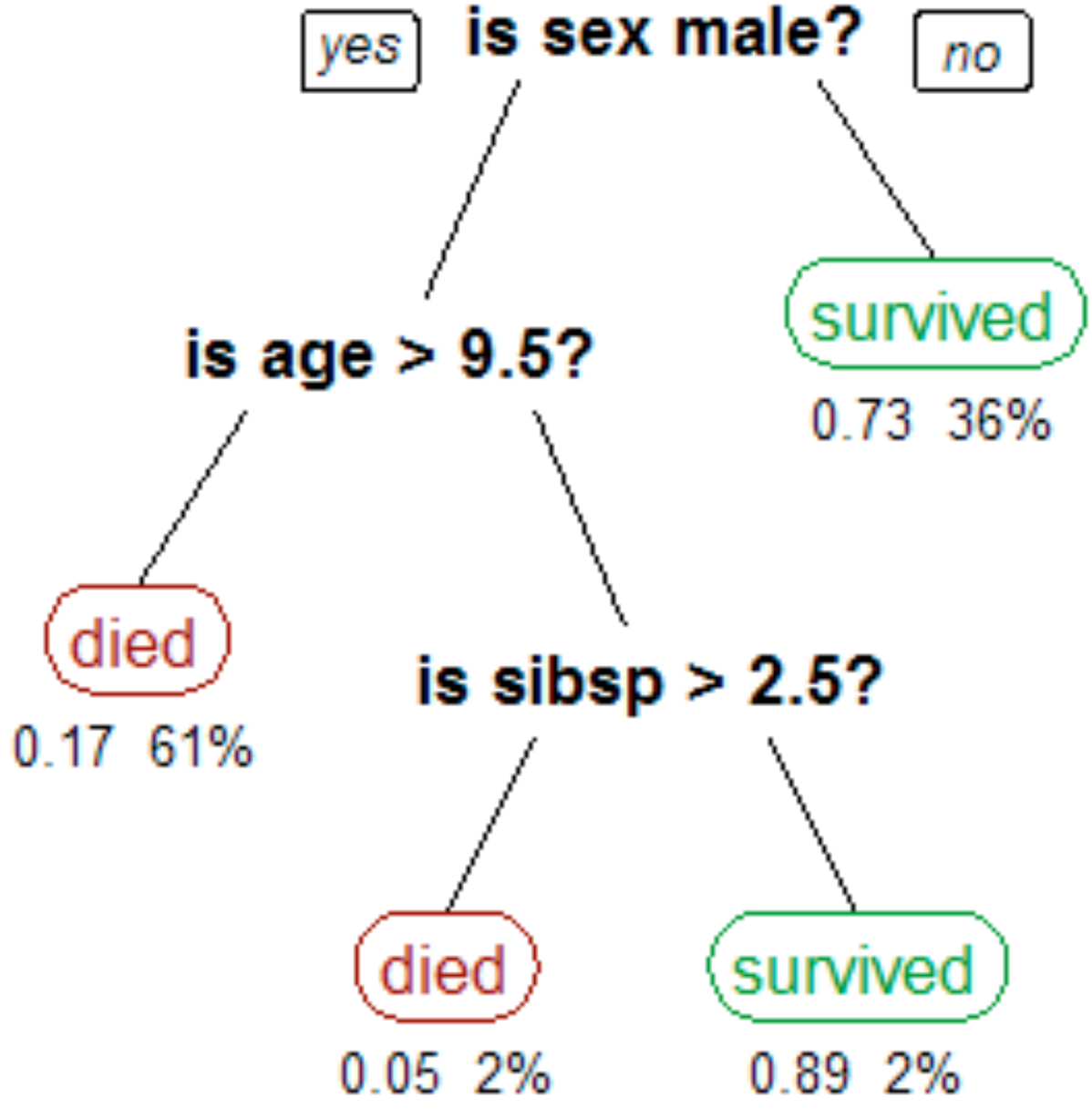
```
vova at va in ~/src/github/whyr_xgboost (master
$ tree .
.
├── LICENSE
├── README.md
├── input
│   ├── sample_submission.csv
│   ├── test.csv
│   └── train.csv
├── models
├── output
└── src
    ├── advanced_model.ipynb
    └── simple_xgboost.ipynb

4 directories, 7 files
```

Understand business and data

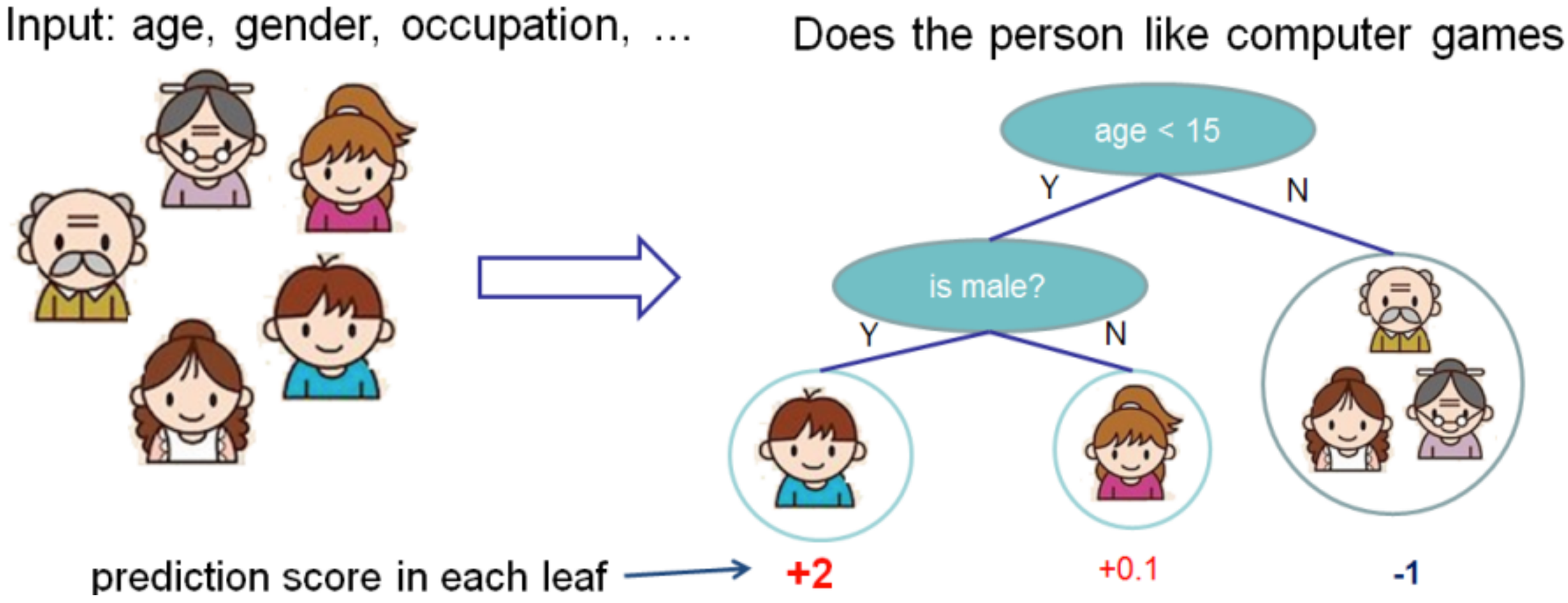
Decision trees

A bit history, why DT is not enough?

Decision Trees (CART)



Decision Tree



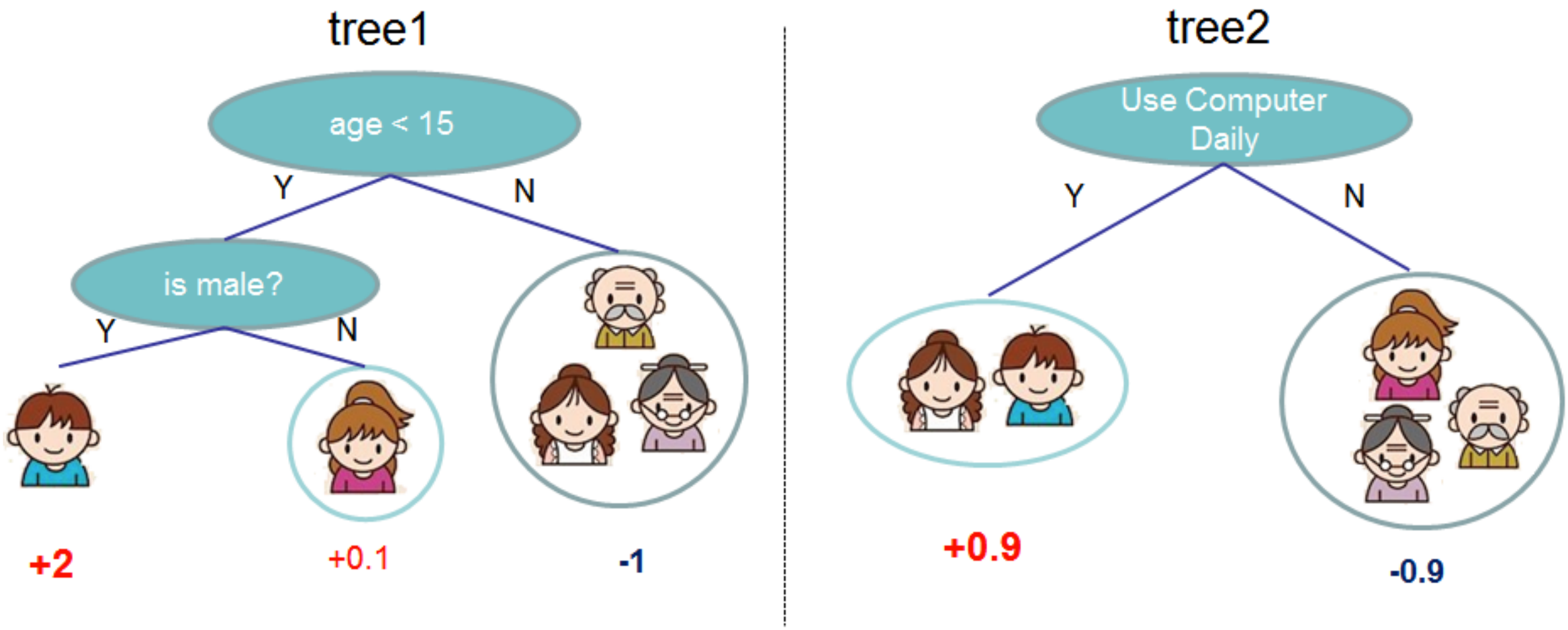
http://xgboost.readthedocs.io/en/latest/model.html

Decision Trees (CART)

pros - interpretable

cons - relatively a poor quality

Ensemble trees



f( ) = 2 + 0.9= 2.9 f( )= -1 - 0.9 = -1.9

http://xgboost.readthedocs.io/en/latest/model.html

Ensembles

Bagging, Random Forest, Bootstrap…

Ensembles

Two heads are better than one

Co dwie głowy, to nie jedna

Одна голова хорошо, а две лучше

Boosting

grant powers to machine learning

Boosting (what)

refers to a family of algorithms which converts **weak learner** *(aka base learner)* to **strong learners**

Boosting (how)

- Using average/ weighted average
- Considering prediction has higher vote

XGBoost

eXtreme Gradient Boosting
or **regularized** gradient boosting

XGBoost is used for **supervised** learning problems

- classification
- regression
- ranking

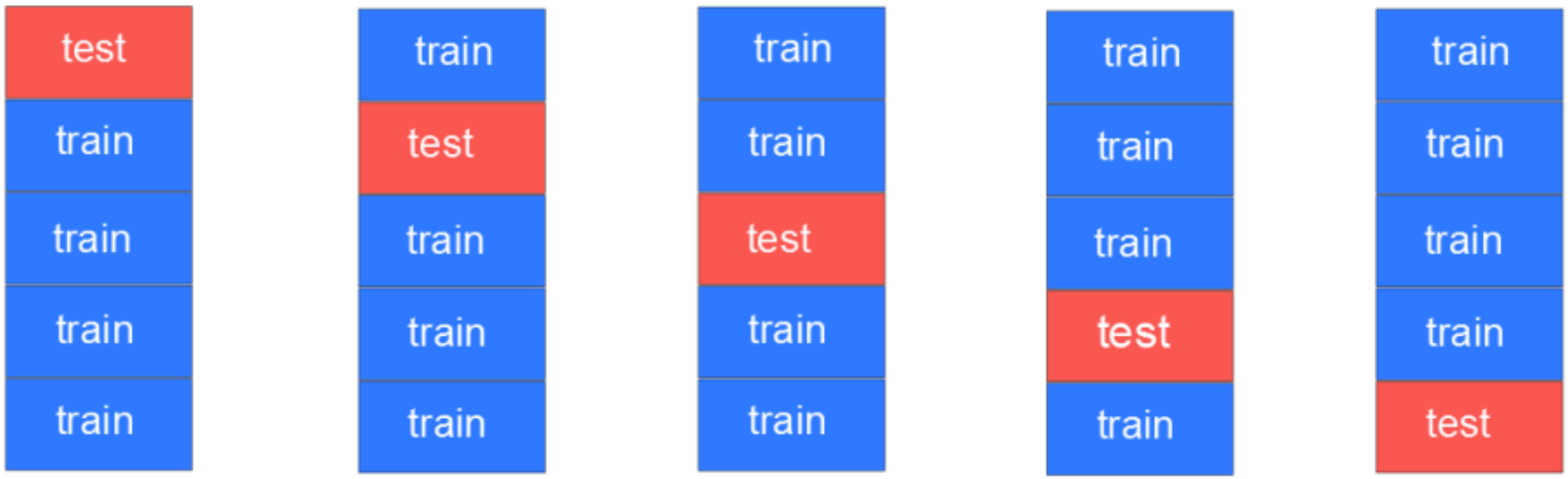
Tianqi Chen

the author of xgboost

Cross validation

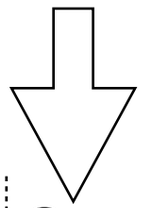
k-fold, leave-one-out, stratified

5-fold cross-validation



Cross-Validation: 3-fold

Age	Gender	Height
20	male	170
30	female	163
24	male	198
28	female	169



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Age	Gender	Height
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28	female	169
20	male	170

Age	Gender	Height
28	female	169

Age	Gender	Height
24	male	198

Age	Gender	Height
30	female	163

Feature Engineering

help a model to do better a job

Feature Engineering

- **Continuous =>** from 1 to 100…
- **dates =>** day, month, year, hour, is weekend…
- **categorical** (red, green, white)
  - assign an unique ID (1, 2, 3)
  - create n-binary columns (is red? etc)
  - probability with target variable (if red 20% then…)

Feature Selection

keep only relevant ones

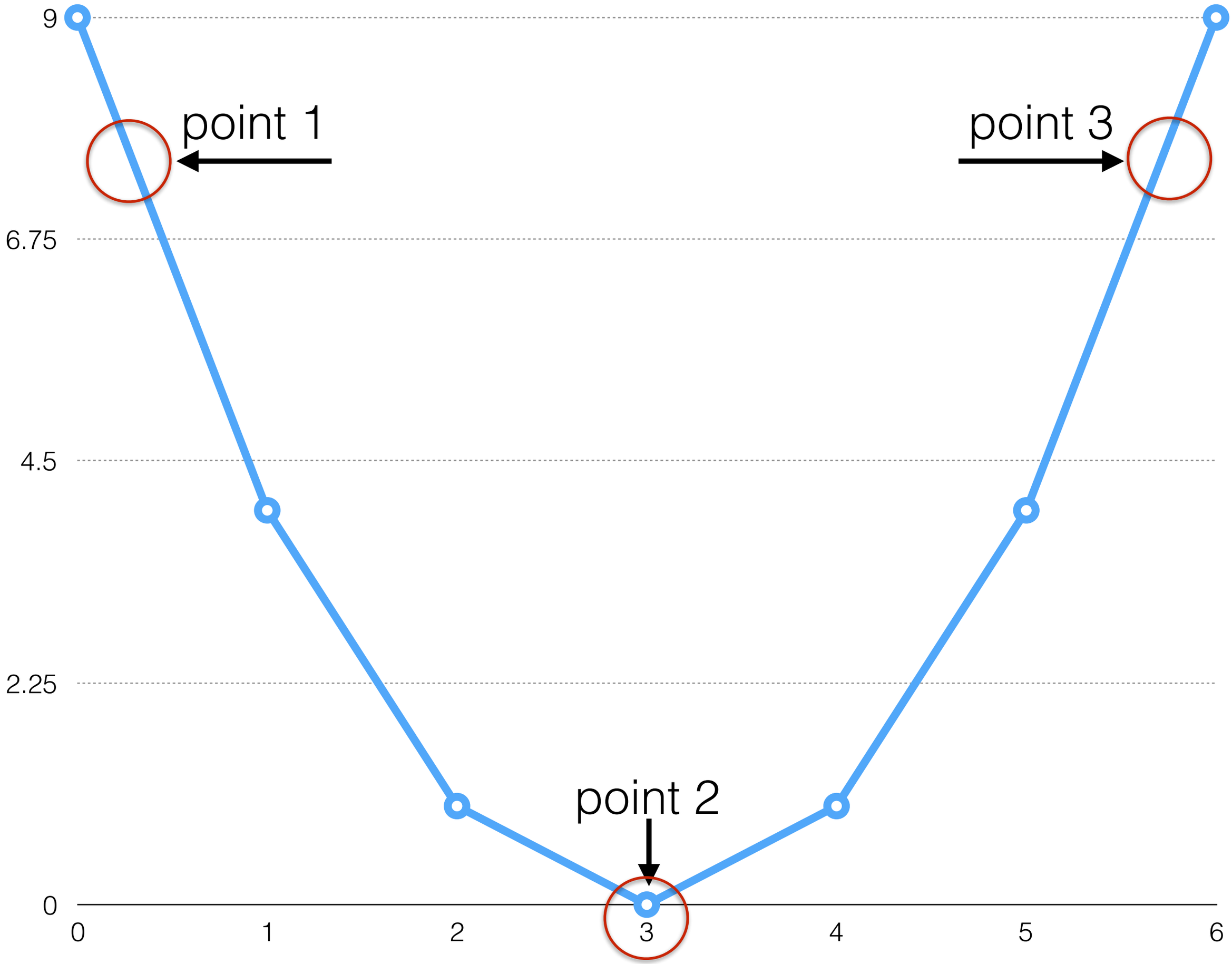
Feature selection

- Less means better (a simple model)
- Keep only the most valuable features (the ideal case - one :)
- Features (usually) depends on each other, be careful… (verify in an empiric way)
- Fewer features - faster solution

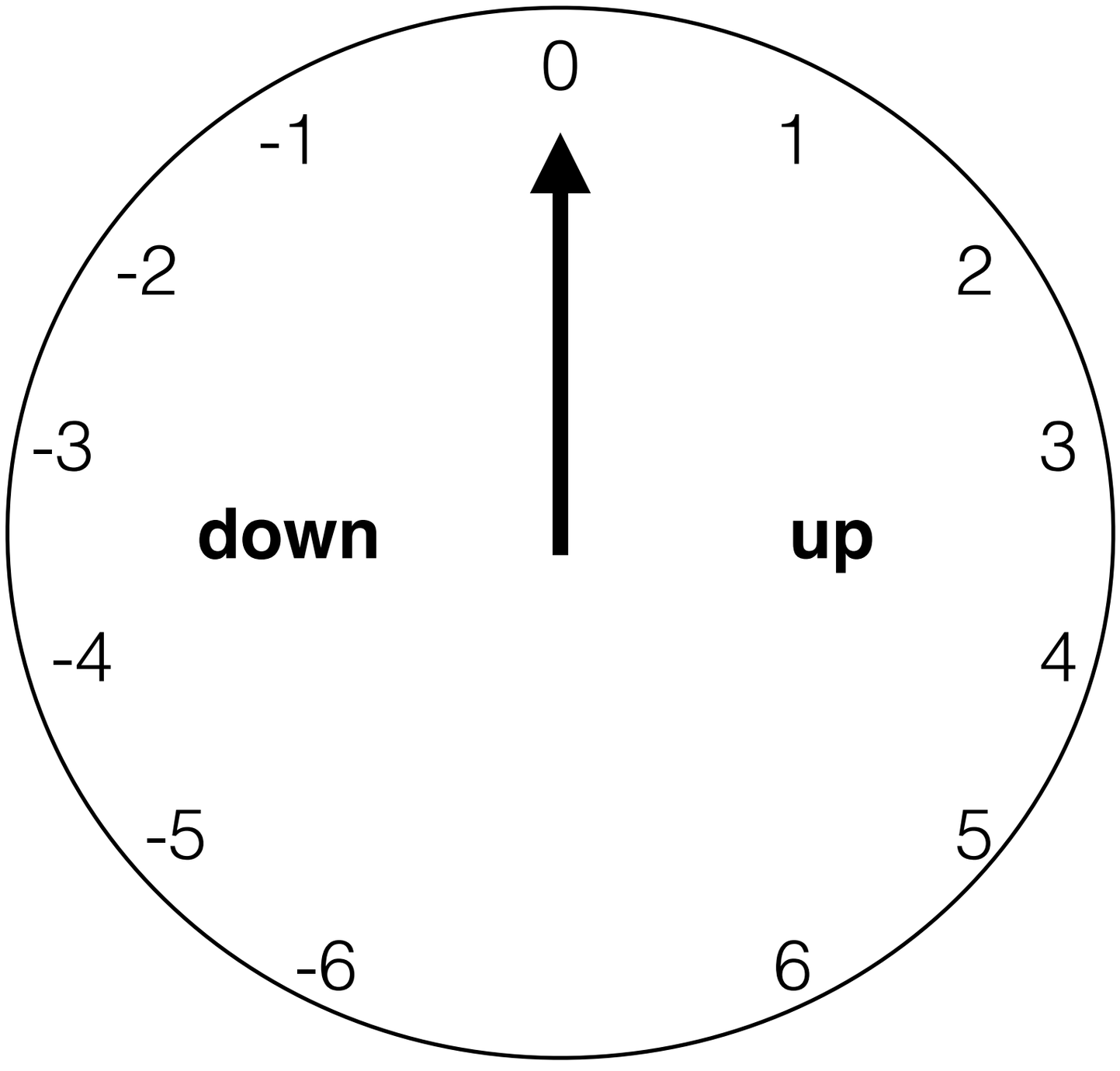
Derivative

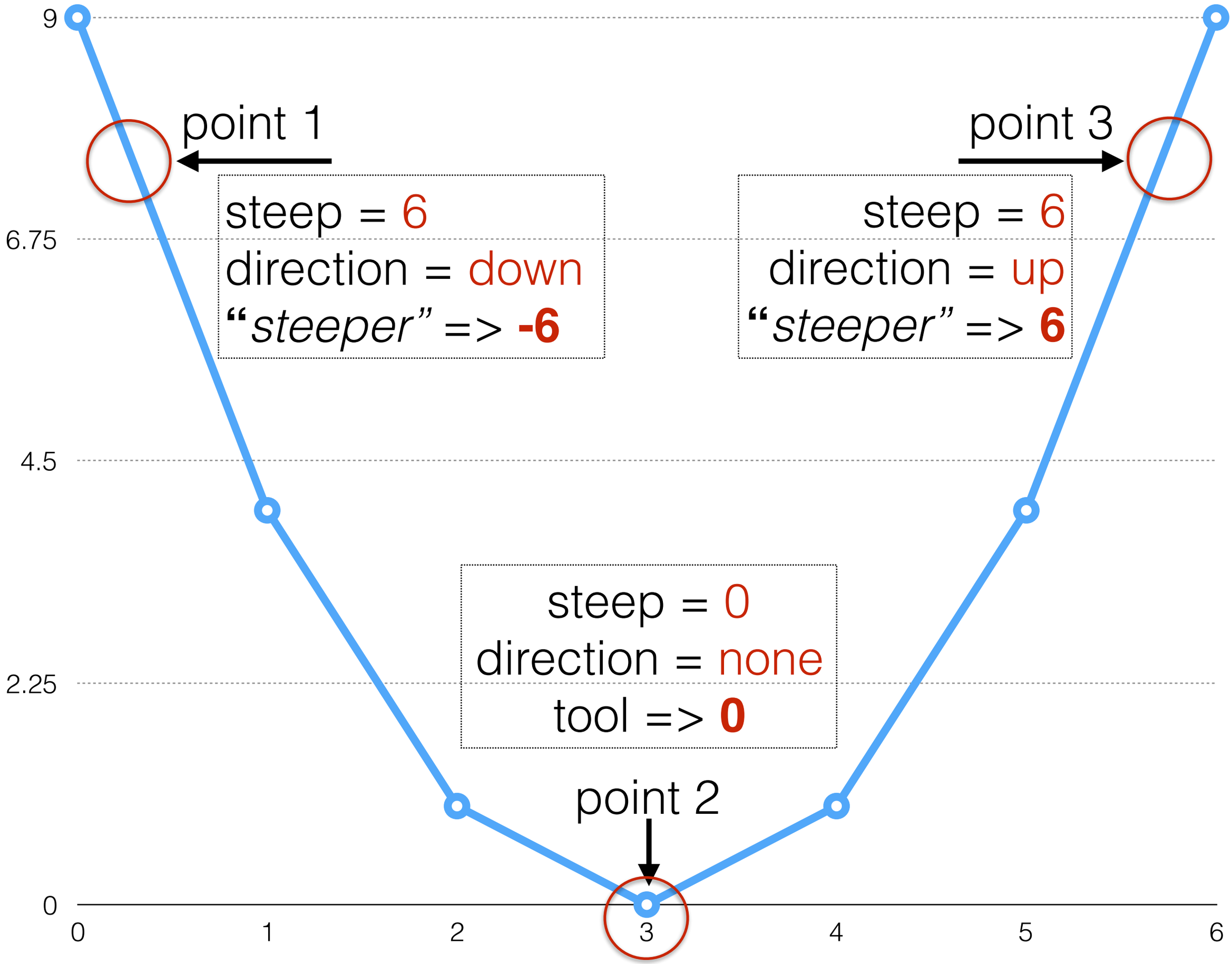
Intuitive example(s)

How **steep** and in which **direction** is **changing height** while car is going to forward?


9
6.75
4.5
2.25
0
0
1
2
3
4
5
6
point 1
point 2
point 3

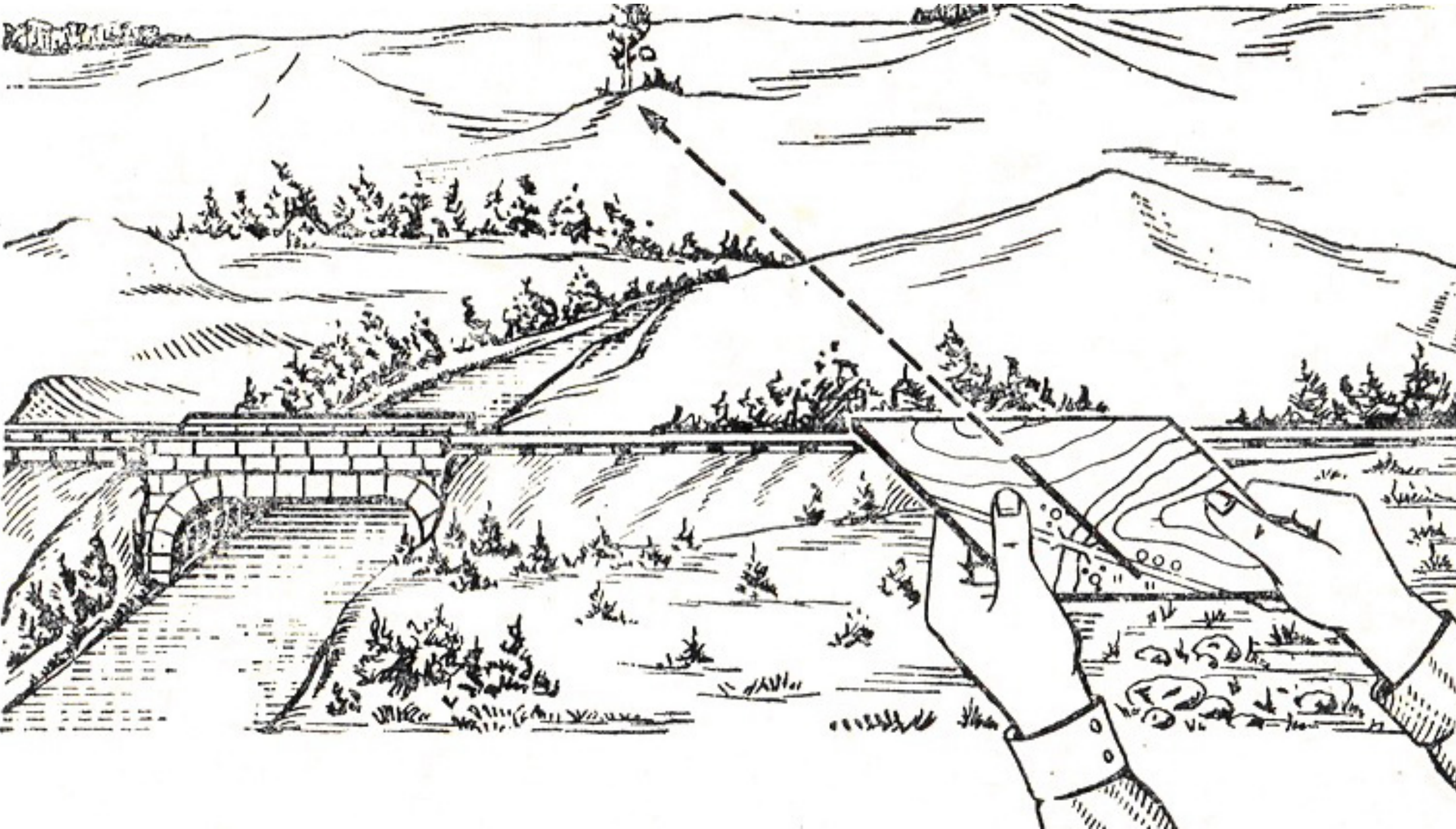
A tool (*steeper*) for measure **steep** and **direction**



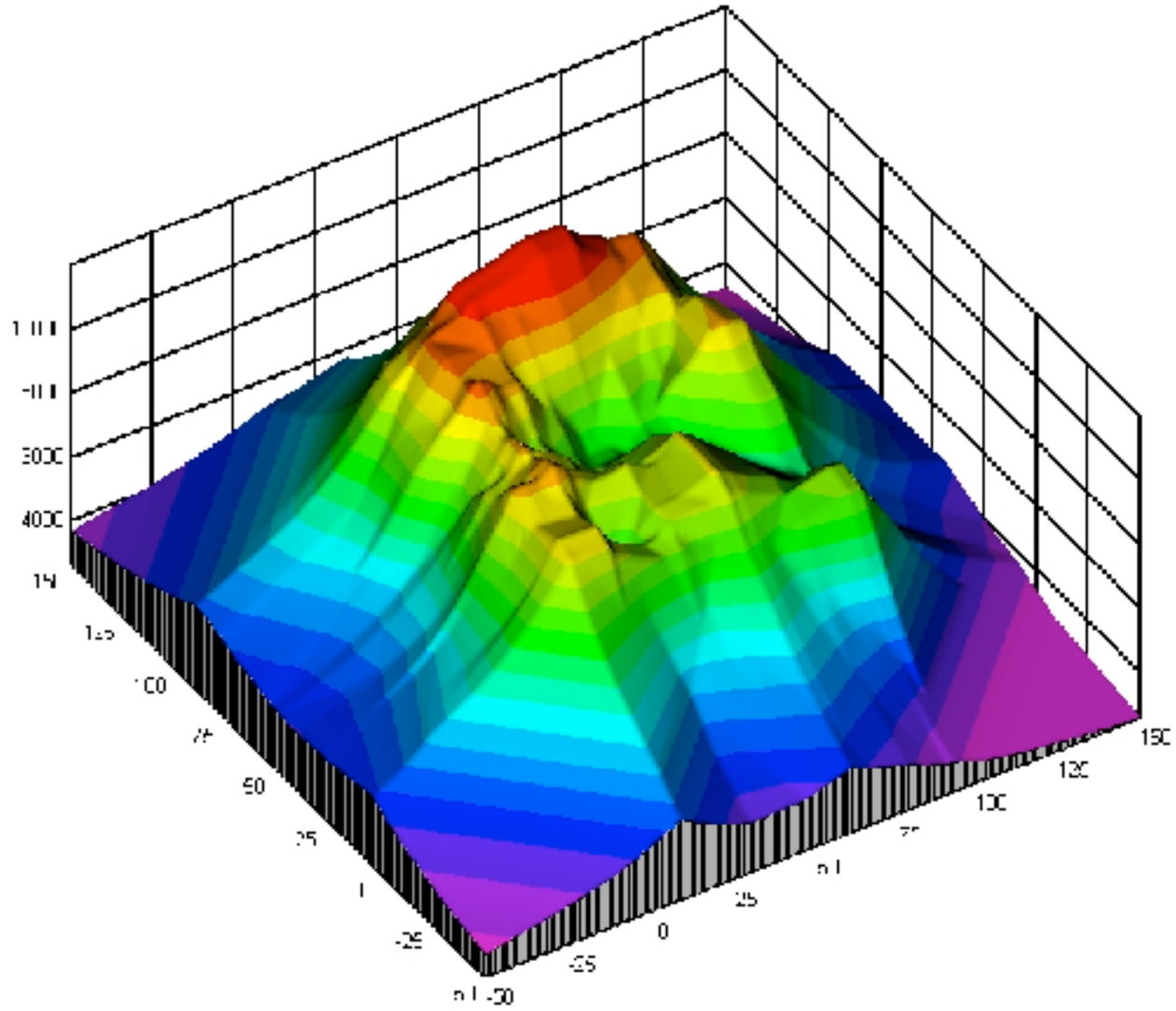

9
6.75
4.5
2.25
0
0
1
2
3
4
5
6
point 1
steep = 6
direction = down
“steeper” => -6
point 3
steep = 6
direction = up
“steeper” => 6
steep = 0
direction = none
tool => 0
point 2

Gradient Descent

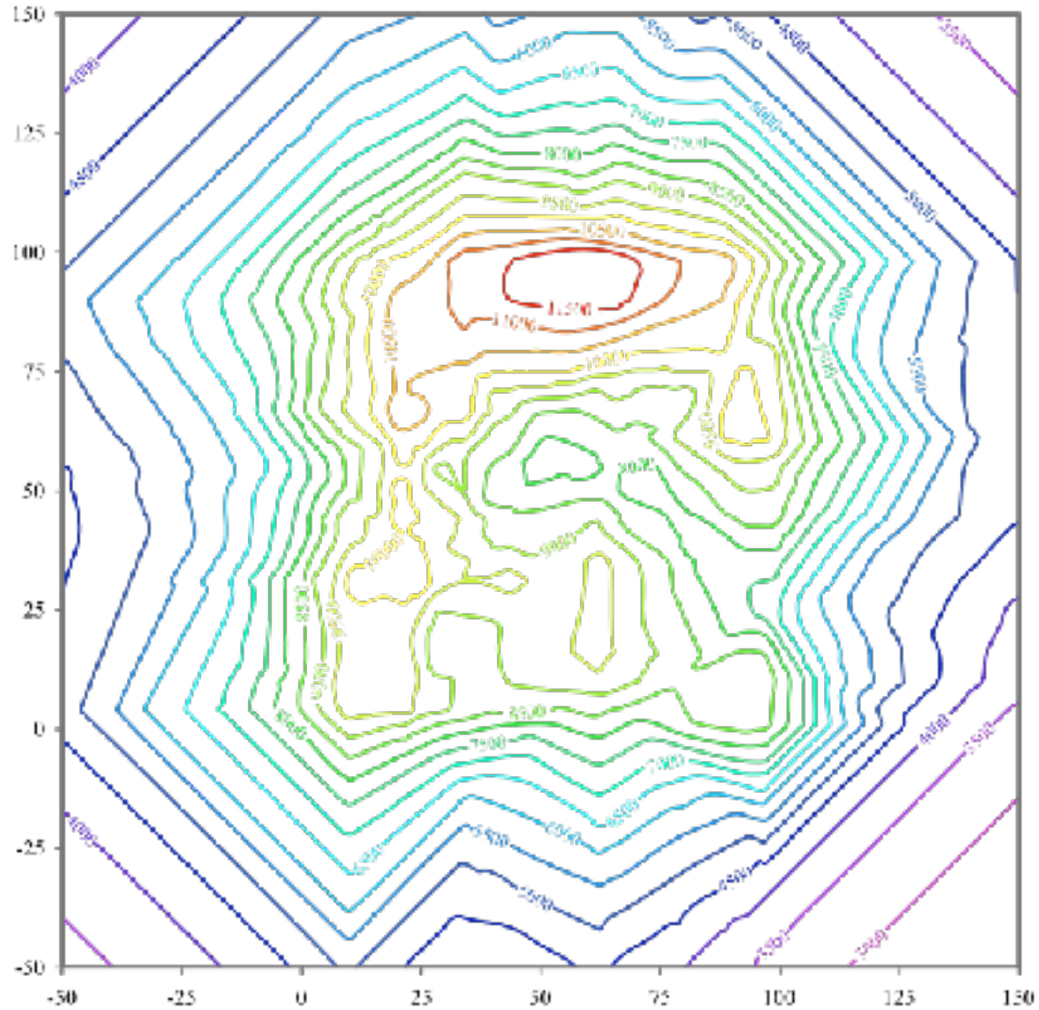
Contour Line



Contour Line

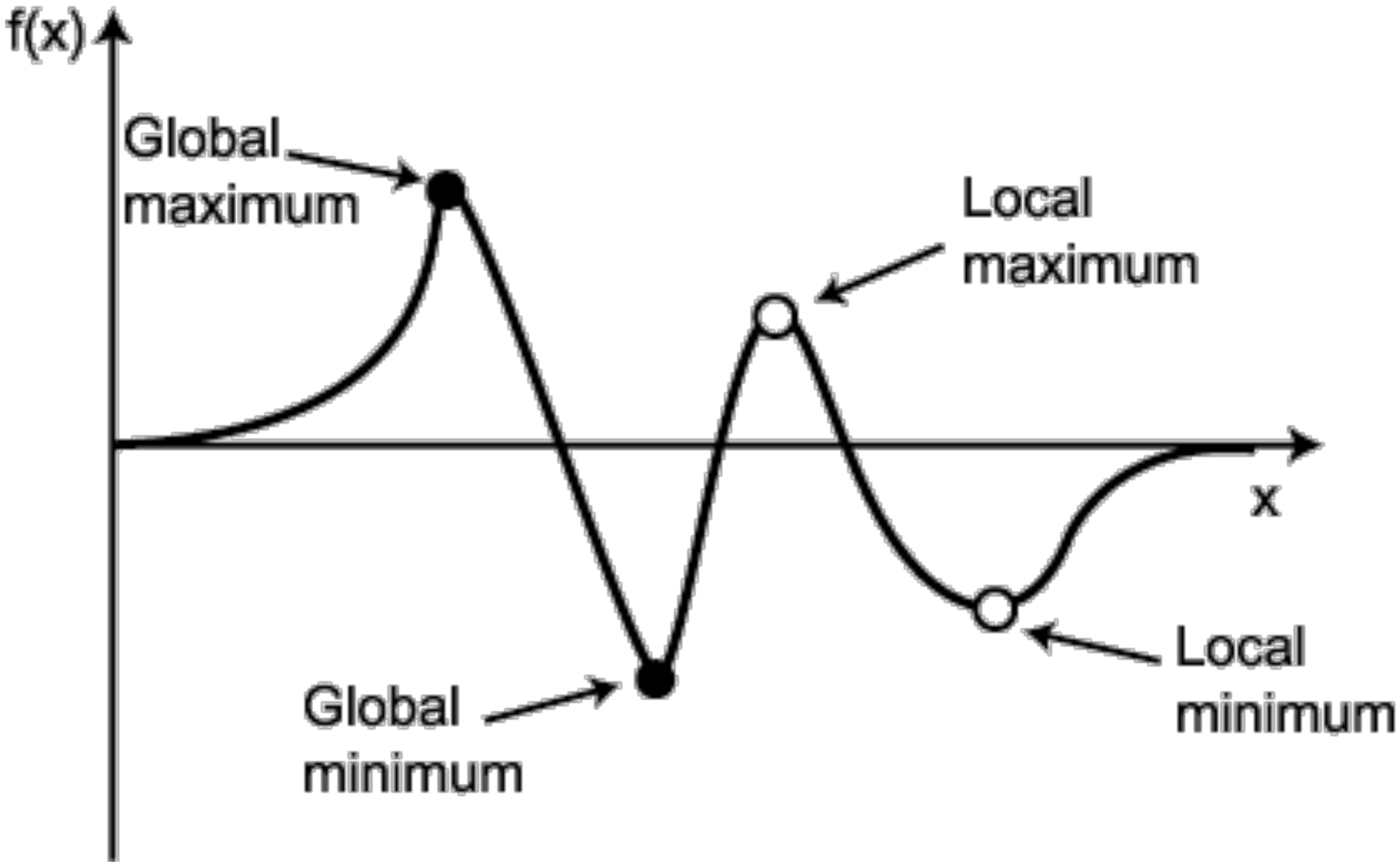


3D



2D

Global/local min/max



Summary

Three things

if you can remember only three…

- **XGboost** is **regularized** gradient boosting
- If you want to **win** try XGBoost
- Be careful with **overfitting**

Thank you

Data Workshop .eu

Praktyczne uczenie maszynowe dla programistów*

* Dla osób, które znają język Python (*jeden z najłatwiejszych języków dla początkujących)*

Uczenie poprzez **przykłady**, bez skomplikowanych i zawiłych (matematycznych) detali

Naucz się, jak zaimplementować **rozwiązanie end-to-end**

Start kursu: 30 października 2017 roku

33	14	38	12
Dni	Godzin	Minut	Sekund

30 WRZEŚNIA O 19:00 BEZPŁATNY WEBINAR

Praktyczne uczenie maszynowe dla programistów

Wszystko co chcesz wiedzieć o zawodzie przyszłości

Dołącz na dataworkshop.eu/free-webinar

biznesmysli.pl

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General Electric


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