LOCOMO: building "local" cost models for N-SET

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Motivation

- Should you let an electrician fix your pipes?
  - No- the skill of electricians and plumbers comes from different training.
- Should you build one cost model to cover all your projects?
  - Not sure… lets check

An experiment

- Take a “partial description” of a project
  - E.g. we use “standard analysts” (in COCOMO speak; “acap=1”)
- Go to a log of old projects
  - E.g. the nasa93 COCOMO-I data sets.
- Find some projects “near” the partial descriptions
  - E.g. find the 20 “nearest neighbors” in nasa93 to acap=1
- Build some cost models from those 20
- Compare those cost models to other “partial descriptions”

e.g. COCOMO models learned from 20 nearest neighbors to acap = 1

a,	b,	mmre,	pred(30)
4.21,	1.07,	19.5,	79.1
4.31,	1.06,	19.6,	80
4.35,	1.06,	19.9,	79.4
3.3 ,	1.14,	20.1,	80.6
4.29,	1.06,	20.2,	77.8
4.5,	1.05,	20.3,	70.3
4.35,	1.06,	20.4,	75.5
3.97,	1.09,	20.7,	81
3.72,	1.09,	24.1,	66.7
3.9,	1.1,	25.6,	72.0

Median performance statistics

10 times,
- Randomize order
- Train = 1 .. 10
- Test = 11 .. 20
- Using the training set, apply Boehm's local calibration method
- Using the test set, apply the calibrated model

Goal: Keep it Simple For the Users

Details hidden from users.

All automatic ("under the hood")

"A" values different to standard COCOMO Values (≤ 3.2)

PRED(30) = % of tests whose predicted is within 30% of actual

"PRED, MMRE" are statistical measures of predictive success

MMRE = mean magnitude relative error
= abs(actual - predicted) / actual

e.g. COCOMO models learned from 20 nearest neighbors to time = 1.1, rely=1.2

a,	b,	mmre,	pred(30)
4.82,	1.05,	46.8,	73.2
4.87,	1.05,	47.9,	73.2
4.84,	1.05,	48.5,	72.9
4.77,	1.06,	49,	72.5
4.84,	1.05,	50.6,	72.2
4.91,	1.05,	52.4,	71.8
5.02,	1.04,	54.9,	71
5.11,	1.04,	57.2,	70.5
5.09,	1.04,	59.2,	69.6
5.06,	1.04,	60.9,	68.6

Median performance statistics

- High-reliability systems,
- Some time pressure on development

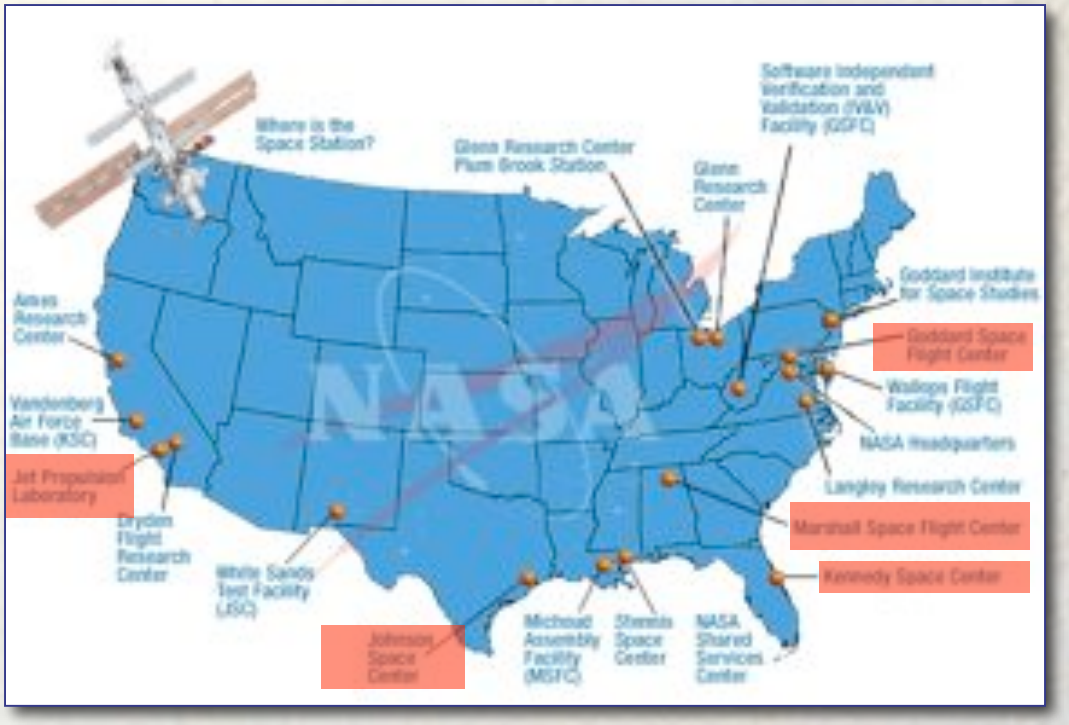
"A" values very different to those seen before

PRED(30) = % of tests whose predicted is within 30% of actual

MMRE = mean magnitude relative error
= abs(actual - predicted) / actual

Urgent need to collect more localized data from local sites

- Current NASA initiative:
  - Tune cost models to specific NASA Center products
- LOCOMO:
  - proof positive that such tunings are essential



Why use LOCOMO?

- LOCOMO.cost = $0
  - http://unbox.org/wisp/trunk/locomo
- LOCOMO based on COCOMO
  - COCOMO: white box
  - Other commercial tools: black box
- LOCOMO: uses NASA-specific data
  - Other commercial tools: mostly DOD
    - Often over-estimate NASA projects since they assume MIL standards
    - MIL assumes more documentation/ testing/ security requirements than NASA
- Estimation with smallest number of variables
  - In our example, only 1 or 2
    - Other tools: dozens to hundreds of variables
  - So, given minimal project information
    - Can still get project estimates
  - And, with more data,
    - Can select more relevant data and get better estimates

LOCOMO: next steps

- Apply this to different NASA sites
- Assess manual vs automatic stratifications
  - Manual: “earth orbit”, “deep space”, “mars projects”
  - Automatic: LOCOMO
  - Which is better?
- Many studies inside “the guts” of LOCOMO
  - Effects on variance of automatic stratification
  - Why pick “20” nearest
    - Why not 5? Or 50?
  - What does “nearest” mean?
    - ? Log transform on the numerics