A Systematic Approach for Test Effort Estimation Model Selection

Ulrike Dowie, Lars Karg
SAP AG

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Motivation and Aims of Our Approach

Criteria to Examine Existing Models

Selection Approach

A Partly Fictitious Case Study

Evaluation
Motivation and Aims

- Deadlines and budgets are missed
- ”Guesstimation” is apparently inadequate to plan test
- Models and methods for test effort estimation exist, but …

Which one to choose?

Aims: Develop a systematic selection approach
- Tailored to domain, organization, and project
- To facilitate comparison between existing models or methods
- To reduce selection effort after first use of the approach
- To select systematically and objectively
Conceptual Framework

Support Assessment and Selection

Test Goals

Test Parameters

Influence

Result In

Test Restrictions

Affect

Test Techniques Efficiency and Effects

Support and Help to Reach
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Evaluation
1. Requirements on the model

- **Falsifiability**
  Assumptions, hypotheses can be refuted by experience
  → portability

- **Objectivity**
  Model is based on formal process, different persons arrive at the same results

- **Model maturity**
  Number of practical applications, diversity of application:
  e.g., number of different organizations, different domains

- **Usage experience**
  User satisfaction → model use continued

- **Usability**
  Comprehensibility, adaptability, applicability

- **Project control**
  Feedback loop, alternative actions suggested?

- **Programming language independence**
2. Match models and organizational context/project

Goals
- Is a goal-oriented process modeled?
- Can model user choose among different goals?

Restrictions and parameters
- Process model, programming language, available tool support
- Historical data quality and quantity (metrics, number of projects, etc.)
- Human resources (statistical knowledge, experience, etc.)
- Test characteristics (comparability of test cases, structural versus functional testing, etc.)

Assumptions concerning effects
- Are assumptions valid in the organizational/project context?
- Results traceable back to causes
Selection Approach

- Preparation
  - Test Effort Estimation Models (TEEMs)
- Domain Restrictions
- TEEMs Applicable to Domain
- Org. Goals & Restrictions
- TEEMs Applicable to Organization
- Project Goals, Restrictions & Parameters
- TEEMs Applicable to Project with Ranking
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Evaluation
Case Study (1/4)

Preparation

- Search for Test Effort Estimation Models (TEEMs)
- Analysis of TEEMs according to criteria (see next slide)

Determination of critical criteria

- Falsifiable (assumptions can be checked against real conditions)
- Usage experience: must be positive (model is still being used)
- Model maturity: practically applied
- Understandable: estimation results must be traceable
- Adaptability: parameter determination must be clear
- Language independent

Feedback loop to control test efforts: nice to have
## Case Study (2/4)

<table>
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<th>Models</th>
<th>Model Is falsifiable</th>
<th>Model Is objective</th>
<th>Usage Experience</th>
<th>Model Maturity</th>
<th>Usability</th>
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Case Study (3/4)

Domain restrictions

- Competitive situation: supplier oligopoly → budget and schedule constraints must be kept
- Bug corrections possible after market release
- Highly variable product usage → not all process chains can be tested → prioritization of test cases is important

Organizational goals (especially regarding TEEMs)

- Model results as additional input for resource planning → model must be applicable early in the product life cycle

Organizational restrictions (especially regarding TEEMs)

- Development process: variant of the V-model
- Languages: object-oriented
- Test cases: project-specific → extent/coverage not comparable
- Use case/function point counts: not available
Fulfillment of critical criteria
- No model is entirely falsifiable → use partly falsifiable models
- One model with positive usage experience → select for further analysis

Matching models with domain restrictions
- Competitive situation → budget and schedule constraints are considered by the remaining model

Matching models with organizational goals
- Model can be used early in the life cycle (requirements must be defined)

Matching models with organizational restrictions
- V-model is supported, object-oriented languages are supported
- Test cases should require similar effort → assumption violated

No TEEM fits domain and organizational restrictions
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Evaluation: Benefits and Use of the Approach

Organizational and project goals need to be identified
- Missing or unclear goals become obvious
- Valuable input for project team’s work

Time dedicated to test effort estimation
- Reasonable, detailed effort estimation is facilitated

Effort estimation not a single person’s task but a group task
- Objectivity instead of subjectivity
- Activities won’t be forgotten as easily (due to cross-checks)

Project, product, and team characteristics required as input
- Project is analyzed more thoroughly and carefully

More reliable test effort estimation
(even when no model is appropriate)
Evaluation: Lessons Learned

- Identify **successfully applied** models only (practical application by itself is insufficient)

- Use **elimination criteria** instead of preselection at domain level

- Contact peers (other software developing organizations) and **share experience** regarding test effort estimation models

- Evaluate **local influencing factors** of the test effort
  - Collect data
  - Interview long-time experienced test coordinators/managers
  - Analyze project data and interviews (graphically, statistically)
Evaluation: Further Research Directions

Framework needs to be applied in several projects
- To reduce time required
- To find objective measurements to replace subjective measurements
- To extend or reduce requirements

More models need to be identified and analyzed
- Falsifiable models: not pretending general applicability, allowing to determine all parameter values locally
- Successfully applied models

Analytical models explaining test effort and its influencing factors are needed
- To be cross-checked in the organization
Bibliography


