



Improving IV&V Techniques Through the Analysis of Anomalies



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Problem

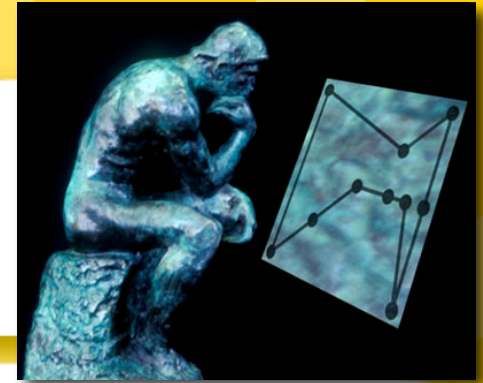


- ➔ How do we recognize an anomalous project?
 - By using automatic analysis of NASA IV&V databases. SILAP, etc

- ➔ But database structures at NASA IV&V are continually changing.
 - How do we deal with this constant evolution?



Approach



➔ The problems with data

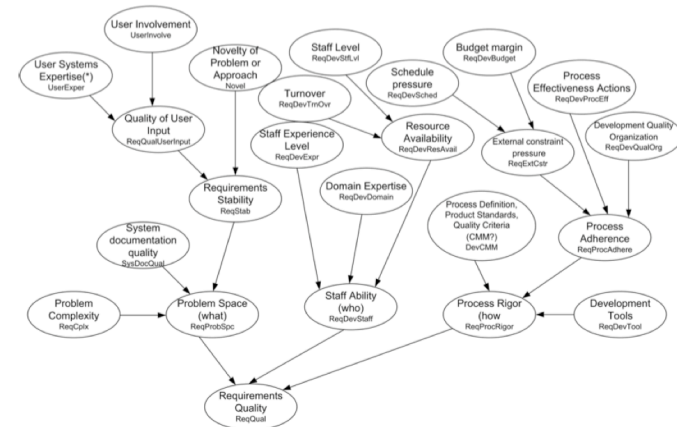
- The sheer amount of data available may make direct analysis impractical or even impossible
- Most project data is ephemeral and/or subjective, making it hard to construct tools for direct analysis

➔ New method

- Build a fast-change format for intuitions about a project
- Use manager expectations for those intuitions
- Initialize the intuitions using Dabney's Bayes nets
- Build a GUI to make the change easy

Approach (details)

- ➔ Create a network that represents a project
 - Nodes are factors within the project
 - Edges indicate the flow of influence
- ➔ Insert manager expectations into the network as specific goals
- ➔ Insert domain knowledge as specific data about certain factors
 - Use the tool to estimate the rest
- ➔ The backend tool evaluates the network and attempts to achieve expectations based on input knowledge
- ➔ A frontend GUI component allows the user to input data and quantify the results
 - (see next page)



GUI component

The screenshot shows the 'Belief' application window. On the left is a table of belief components. On the right is a network diagram showing relationships between these components. At the bottom left is a histogram for the 'RRdUML' component.

Name	Type	Pri.	Op.	Err.
ReqDevProcEff	N/A	0	null	0%
ReqDevStaff	N/A	0	null	0%
ReqQual	Given	0	null	0%
RRdPress	Given	0	null	0%
RRdUserInvolve	N/A	0	null	0%
RRdFocus	N/A	0	or	0%
RRdReviewQual	N/A	0	null	0%
RRdSim	N/A	0	null	0%
RRdReason	N/A	0	null	0%
RRdUML	Given	0	null	0%
RRdTools	N/A	0	or	0%
RRdTech	N/A	0	or	0%
DRRd	N/A	0	or	0%
FPRRRd	Goal	200	or	0%

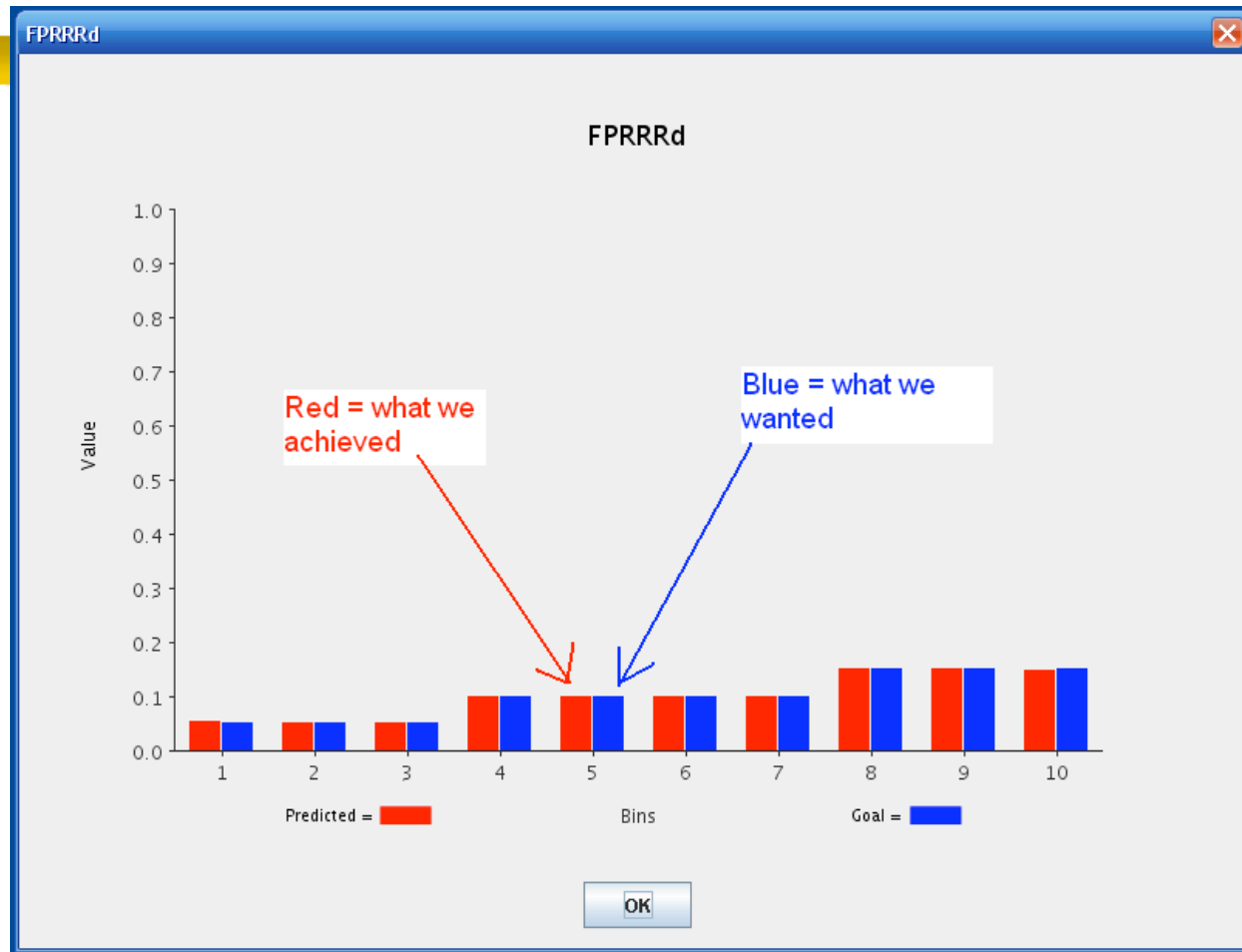
Histogrammic Distribution

Distribution: 1 1 1 2 2 2 2 3 3 3

Description: 11 << Min Mutable Max >> 22

Achieved Goal

GUI component (contd.)





Relevance to NASA

- ➔ Management of software projects = difficult
 - How to control them?
 - New methods introduce new opportunities for anomalies
 - Anomaly detection for new methods is not always easy
 - Anyone can see the fire. Can you see the smoke?
- ➔ Old world: collect measures.
 - But what to collect
- ➔ Here: use background knowledge (from Dabney) to inform data collection and interpretation
 - Generalized strategies for detection and minimization are needed
 - From anomaly detection to repair



Accomplishments

- ➔ After a first round of user trials with...
 - Experienced NASA developers/managers
- ➔ ...refinements to usability and addition of features
- ➔ Migration of the backend to Java
 - 0.016 seconds, not 43 seconds
 - Allows more direct interfacing with the actual network evaluation aspects
 - First version of an ability to generate recommendations for refinement of expectations



Next Steps



- ➔ Required: More user trials
- ➔ Update usability requirements based on feedback
- ➔ Implement further usability features