Software Visualization Today – Systematic Literature Review

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Abstract. In this document we present additional material related to the results of our literature review.

1 Thematic Analysis

Additional material of thematic analysis includes listings to the themes that arose from the main goals and main results of the included articles. We present also references to the articles.

Note that the lists presented may not be complete in the sense that the articles may not be the only articles in the survey addressing the topics. This is due the fact that the thematic analysis was done only for the main goals and results of the articles, not to the whole body of the article.

Why software is visualized?

In Table 1 the themes describing why software is visualized are listed with citations to the articles the themes arose from.

What is visualized?

In Table 2 the themes describing what is visualized are presented also with citations to the articles the themes are present.

To who software is visualized?

Users of software visualizations addressed in the articles are listed in Table 3.

Table 1. Themes that answer the questions *"Why software is visualized?"* with citations to the articles where the themes arose from.

Why software is visualized?	**Articles**
Program comprehension	[66, 56, 29, 44, 40, 27, 46, 69, 60, 72, 30, 12, 1, 47, 54, 67, 32, 33, 52, 42, 31]
Collaboration and engagement	[66, 37, 29, 44, 60, 72, 6, 49]
Maintenance	[70, 56, 14, 2, 46, 49, 33]
Reverse- and re-engineering	[79, 27, 9, 46]
Support	[66, 29, 8, 38, 71, 22, 73, 35, 33, 62]
Optimization	[2, 39, 30, 71, 47, 22]
Managing projects	[59, 29, 62, 49]
Understanding developers	[15, 57, 12]
Assessment	[21, 9]
Comparison	[3, 71]

Table 2. Themes that answer the question *"What is visualized?"* with citations to the articles where the themes arose from.

What is visualized?	**Articles**
Structure of software	[26, 56, 61, 75, 15, 37, 34, 14, 65, 44, 20, 10, 46, 5, 7, 60, 28, 72, 12, 17, 43, 32, 61]
Change	[41, 51, 70, 26, 83, 56, 63, 36, 75, 15, 64, 37, 29, 34, 12, 54, 42, 33]
Execution of software	[65, 44, 77, 20, 53, 81, 4, 3, 78, 68, 5, 60, 39, 71, 12, 47, 22, 35, 67, 31]
Code quality metrics	[79, 70, 61, 48, 65, 44, 27, 9, 11, 5, 7, 28, 1, 17, 43, 32]
Working habits	[66, 26, 83, 15, 57, 37, 29, 14]
Performance	[59, 20, 13, 19, 53, 78, 2, 71, 22]
Dependencies	[79, 55, 51, 75, 15, 44, 39, 47, 54, 49, 24]
States of project	[26, 37, 48, 5]
Resource usage	[20, 53, 68, 22]
Time	[12, 47, 67, 42]
Software product line variants	[79, 55]
User's activities	[59]
Data flow	[45]
Work flow	[42]

Visualization methods

Interaction related aspects were discussed in many papers including these: [79, 55, 66, 70, 26, 83, 61, 15, 37, 48, 44, 74, 58, 60, 28, 6, 1, 47, 42, 17, 33, 43, 62, 61].

The visualization techniques related themes and references to articles they are collected from are listed below.

- Trees and Graphs [14, 60, 39, 1, 42, 33, 18, 82]
  - Node link diagram [51, 9, 1]
  - Treemap [41, 75, 30]

Table 3. Themes that answer the question *"Who software is visualized?"* with citations to the articles where the themes arose from.

Users	Articles
Software developers	[66, 83, 29, 14, 38, 12, 32, 25]
Software architects	[56, 11, 46, 69, 30]
Testers	[26, 59]
Managers	[51, 26, 62]
Integrators	[36]
Software teams	[59]
Designers	[5]
Visualization developers	[66]
Domain experts	[55]
Different user groups	[27, 62]
Multiple users	[6]
Requirements engineers	[62]

    - Matrix presentations [70, 10, 1, 17]
    - Layout algorithms [41, 75, 14, 16, 5, 47, 22, 35, 43, 18]
- Polymetrics views [75, 80, 33, 32]
- Source code views [65, 38, 28, 17]
- Tag clouds [37, 25]
- Clusters [46, 65, 77, 72]
- Timelines [51, 15, 64, 44, 67]
- Animations [70, 72]
- Pixel oriented techniques [2, 17]
- Heat map [51, 29, 68, 12]
- Multiple views [28, 42, 52, 49]
- Multiple coordinate views [42]
- Dashboard [36]

Visualization tools

The visualization tools, methods and concepts discussed in the articles are listed below. Note that the list may not be complete as the tools and concepts are retrieved only from the main goals and results of the research articles, not from the entire body of the article.

1. Code Pad [66]
2. AniMatrix [70]
3. Chrono Twigger [26]
4. Samoa [56]
5. Complicity [61]
6. Torch dashboard [36]
7. Concept Cloud [37]
8. CEREBRO [65]
9. VIMETRIK [48]

10. TRACEDIFF [77]
11. WEDJAT [13]
12. VDP [81]
13. Zinsight [23]
14. Heapviz [4]
15. Trevis [3]
16. AllocRay [68]
17. CodeSurveyor [40]
18. regVIS [76]
19. SeeIT 3D [74]
20. E-Quality [27]
21. CodeCity [80]
22. Complicity [61]
23. Decluvi [46]
24. Code smell detector [58]
25. JIGSAW [69]
26. PhysViz [72]
27. The Constellation Visualization [24]
28. CodeSurveyor [50]
29. TAGGLE [25]
30. ReCVisu+ [62]
31. Intreaction Room [49]
32. MetricAttitude [32]
33. MetricAttitude++ [33]
34. OctMiner [52]
35. VisTrails [52]
36. ExplorViz [31]
37. EXTRAVIS [31]
38. Performance evolution blueprint [71]
39. Rizel (code execution profiler) [71]
40. SourceVis [6]
41. SYNCTRACE [47]
42. Visualization tool for resource usage visualization for MapReduce, DUCC and Watson Deep QA platforms [22]
43. GZOLTAR [35]
44. Team WATCH [54]

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