Usage and Attribution of

stackoverflow Code Snippets in GitHub Projects

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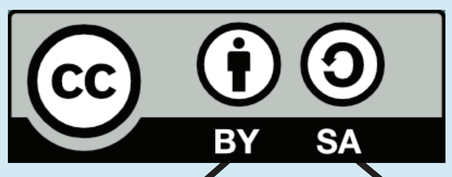
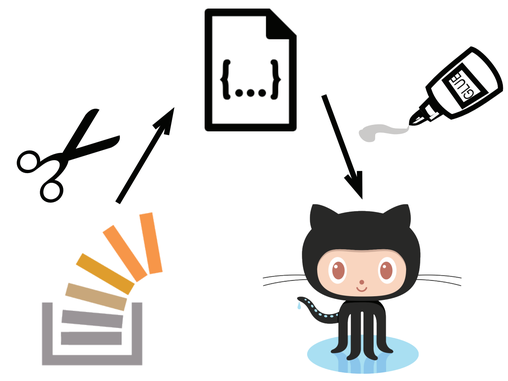
License of Stack Overflow Content



Attribution: Developers using code snippets from Stack Overflow must attribute author and origin of the snippet.

Share Alike: Derived work must be distributed under the same license.

Usage without attribution leads to legal and maintenance issues.



Research Questions

RQ1: How is content from Stack Overflow referenced in GitHub projects?

RQ2: What properties do frequently referenced questions and answers from Stack Overflow possess?

RQ3: How often is code from Stack Overflow posts used, but not attributed?

RQ1

Method: We searched for references to Stack Overflow content in source code files using the BigQuery GitHub data set and a regular expression. Then, we quantitatively and qualitatively analyzed the found references and referenced code snippets.

Results:
- On average **three times more references to whole threads** than to specific answers.
- One out of 357 files (0.28%) and one out of 32 repositories (3.15%) contained a reference to Stack Overflow.
- JavaScript, Python, and R contained more references than other languages.

RQ2

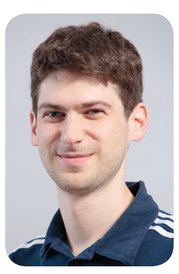
Method: We further analyzed the data collected for RQ1.

Results:
- Frequently referenced questions and answers have a **significantly higher view count and score**.
- However, the dispersion of values is relatively high.

RQ3

Method: (1) We build regular expressions matching the ten most frequently referenced Java code snippets and used BigQuery to match and analyze source code files. (2) We calibrated and used a code clone detector to find exact clones of Java snippets in a random sample of active GitHub Java projects.

Results:
(1) For the code snippets from the ten most frequently referenced Java answers on Stack Overflow, we found that **at most 27% of their usages were attributed** (in all GitHub Java projects).
(2) Using the code clone detector CPD, we found that in a random sample of Java projects (n=2,313), 207 repositories (9%) contained a copy of a snippet from our set of snippets (n=396). **Only 19% of the matched files contained a reference to Stack Overflow**.



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