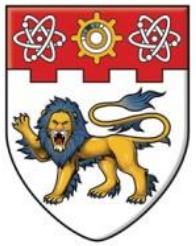

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Towards Correlating Search on Google and Asking on Stack Overflow

Chunyang Chen, Zhenchang Xing

Background

- Stack Overflow
  - 12m questions, 19m answers, 5.6m users;
  - A huge treasure with knowledge covering most parts in Software Engineering;
  - Many research works had been carried out to mine Stack Overflow

Motivation

- Can Stack Overflow represent the interest of developers around the world?
- Many research works had been carried out to mining Stack Overflow, but no one considered this question.
- We expect to demonstrate the representativeness of Stack Overflow so that to lay the solid foundation for further mining in Stack Overflow.

Goal

- Are there relationships between the queries developers use in search engines and the questions developers ask in Q&A sites?
- Google is the dominating search engine and most developers use Google
  - Its search log can definitely indicates developers' interest
  - Google Trends provides the statistics of a search item that people use as query to search Google
- Once we can demonstrate that correlation exists between Google Trends and Stack Overflow, Stack Overflow is representative.

Dataset

- Select technical terms (i.e., tags in Stack Overflow):
  - E.g., c#, visual-studio, ios, jquery, android-layout (no ambiguiation)
- Collect frequent search and asking technical terms
  - i.e., collect frequent co-occurring keywords of terms mentioned above
- Build search and asking trends for technical terms
  - Collect time-series data of term usage frequency both in Stack Overflow (300 weeks) and Google (574 weeks) and normalize them to 0~1 for comparison.

TECHNICAL TERMS SEARCHED AND ASKED

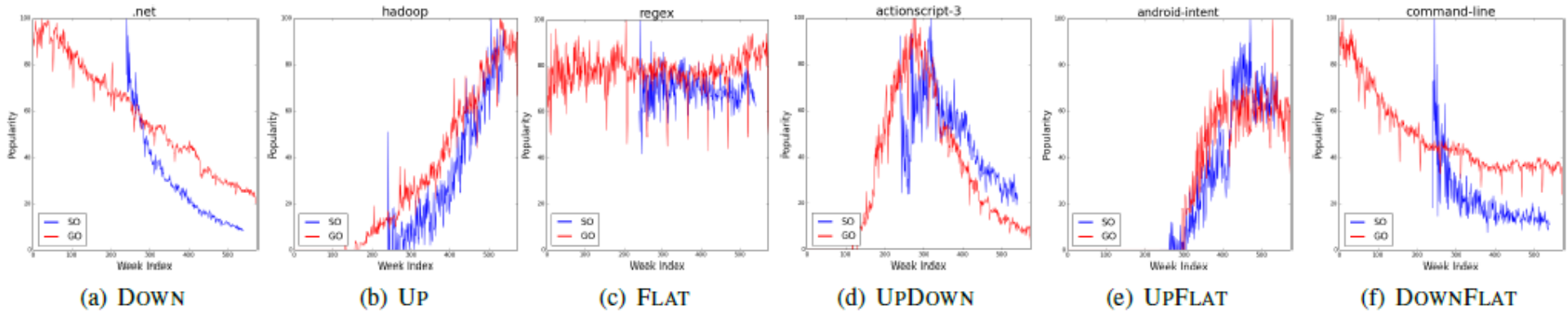
- Given 185 technical terms, 65% of their co-occurring terms in Google and Stack Overflow overlap.

Google

Stack Overflow

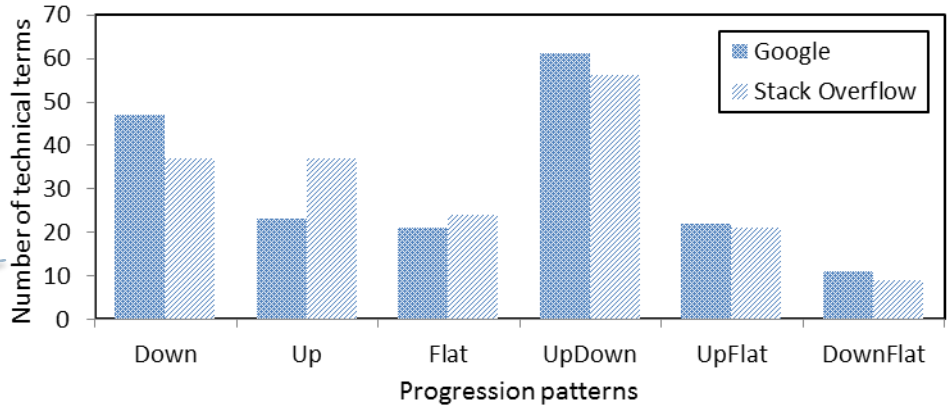
Patterns of search and asking trends

- There are six trend patterns



(a) DOWN (b) UP (c) FLAT (d) UPDOWN (e) UPFLAT (f) DOWNFLAT

- Distribution of term number in different trend patterns



Similar number in each pattern

Alignment of search and asking trends

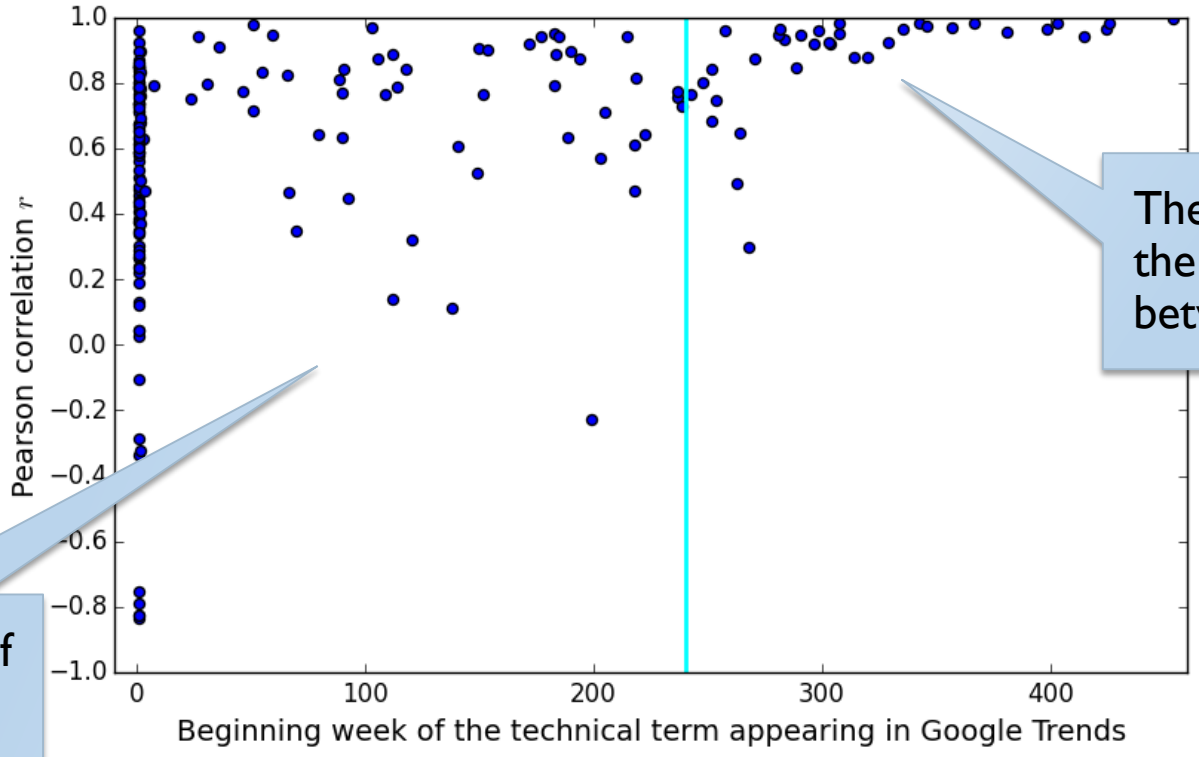
- We adopt cross correlation to compute the Pearson correlation coefficient and delay between two trends for each term.

Input: Search trend T_s and Asking trend T_a of a technical term
Output: maxCorrelation, delay
maxCorrelation = -1 ;
for w *in* $-239 : 35$ **do**
    $T_{s-seg} \leftarrow T_s.getSegment(w, w + T_a.len)$;
    $r \leftarrow$ pearson(T_{s-seg}, T_a) ;
    if *corr* $>$ *maxCorrelation* **then**
        maxCorrelation $\leftarrow r$;
        delay $\leftarrow w$;
    end
end

Algorithm 1: Cross correlation of search and asking trends

Alignment of search and asking trends

- The relationship between correlation and beginning week of the technology:

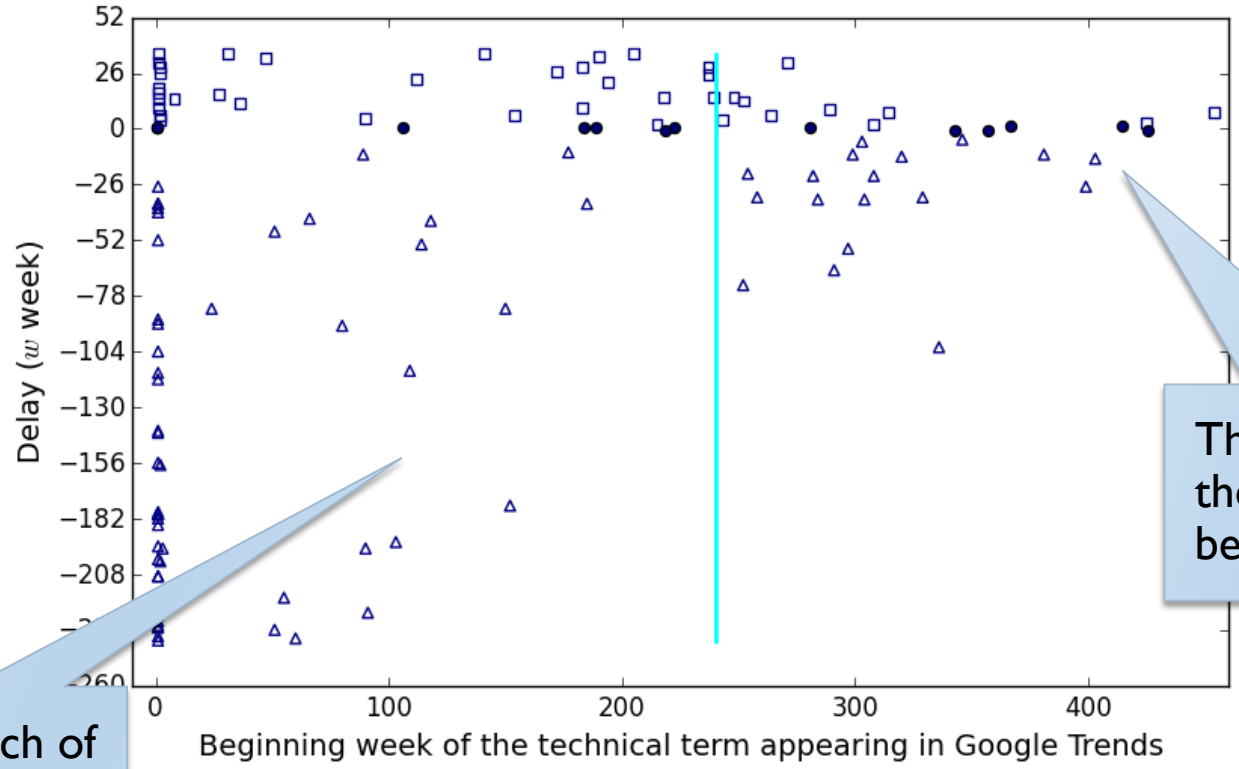


The newer technology, the higher correlation between two sources.

At the launch of SO, no obvious correlation

Alignment of search and asking trends

- We also explore the delay between trends.

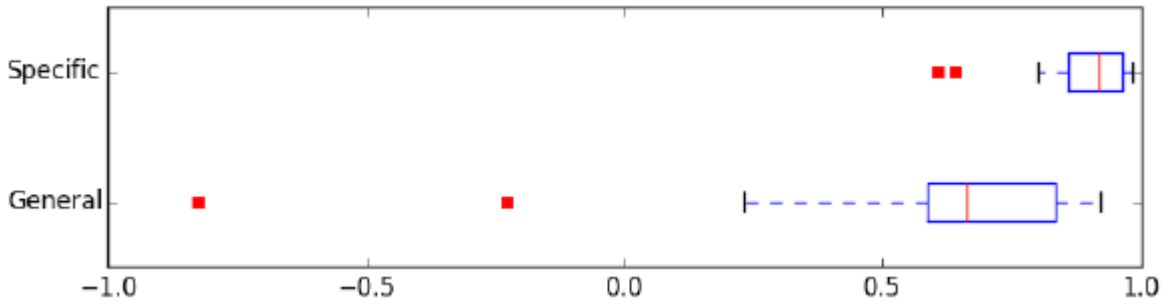


The newer technology, the shorter delay between two sources.

At the launch of SO, it is always behind Google

Trends between general & specific technical terms

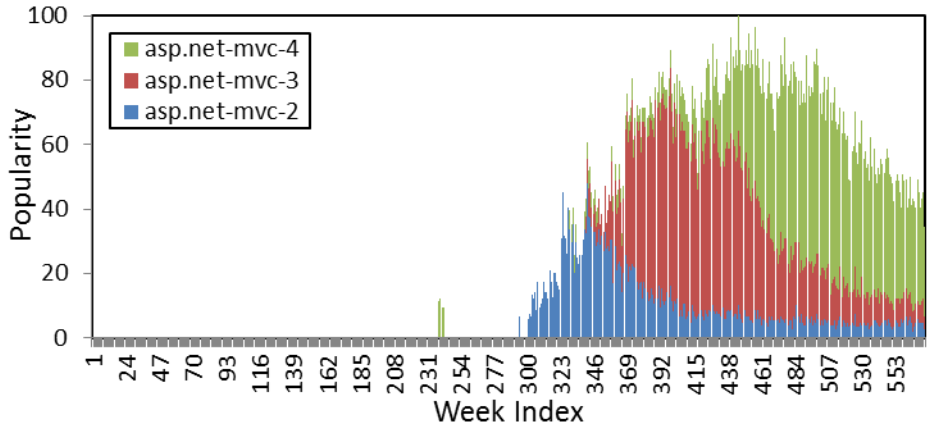
- Some general terms also have different specific version number
  - E.g., visual-studio: vs2008, vs2010, vs2012
    python: python-2.7, python-3.x



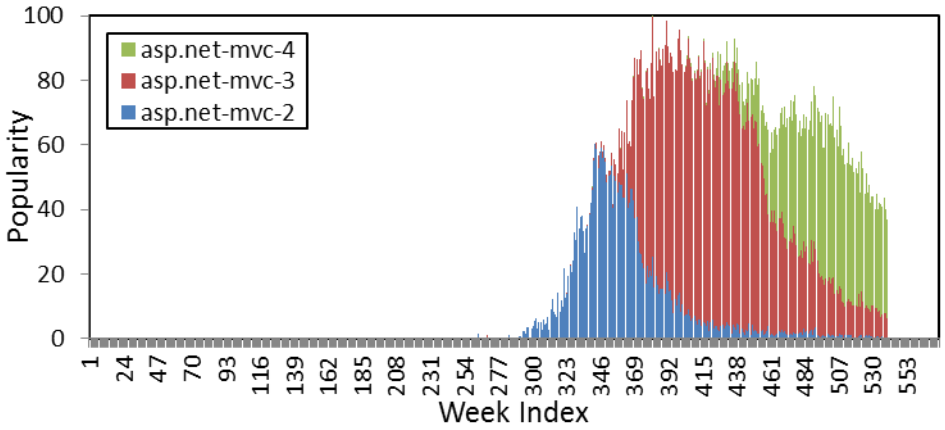
  - High correlation for specific terms (vs2008, python-2.7), low correlation for general terms (visual-studio)

Trends between general & specific technical terms

- Replacement process
  - New technology is replacing old ones;
  - High correlation also exists between aggregated asking and search trend (e.g., asp.net-mvc).



Google



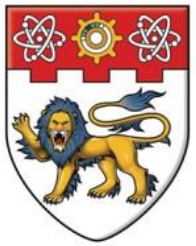
Stack Overflow

Conclusion

- There is correlation between asking in Stack Overflow and searching in Google especially those new technologies.

- The results ensure the representativeness of Stack Overflow as a software repository for further research.

Chen, Chunyang, and Zhenchang Xing. "Towards correlating search on google and asking on stack overflow." In *2016 IEEE 40th Annual Computer Software and Applications Conference (COMPSAC)*, vol. 1, pp. 83-92. IEEE, 2016.



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Thanks for listening

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