CIKM 2020 19-23 OCTOBER Online

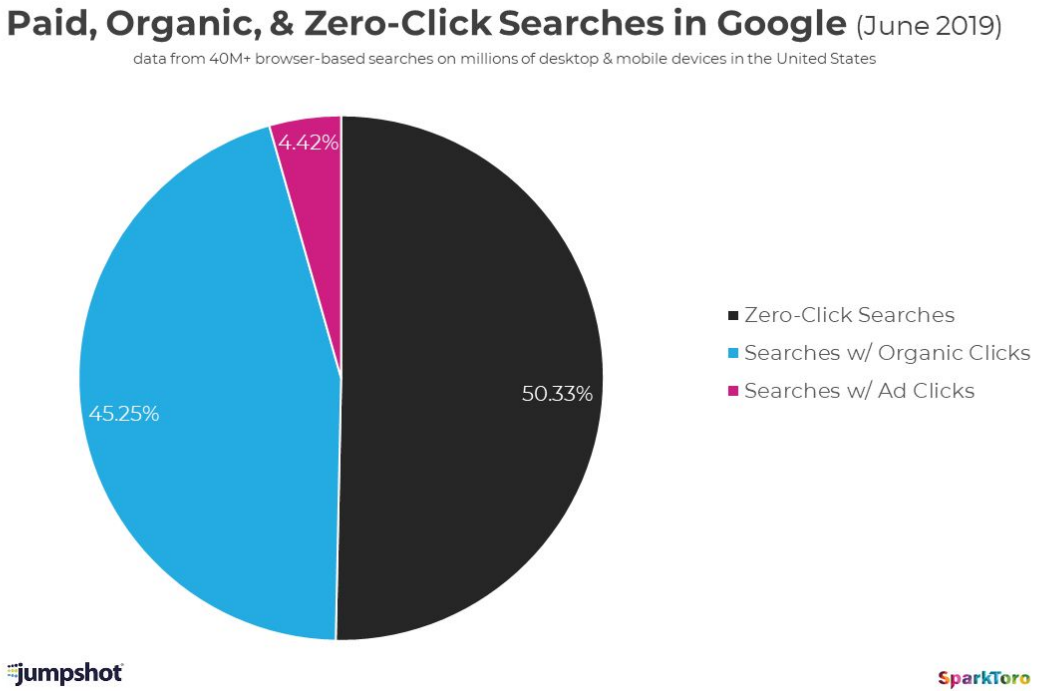
Aalto University

Query Abandonment Prediction with Recurrent Neural Models of Mouse Cursor Movements

Lukas Brückner, Aalto University
Ioannis Arapakis, Telefonica Research
Luis A. Leiva, Aalto University

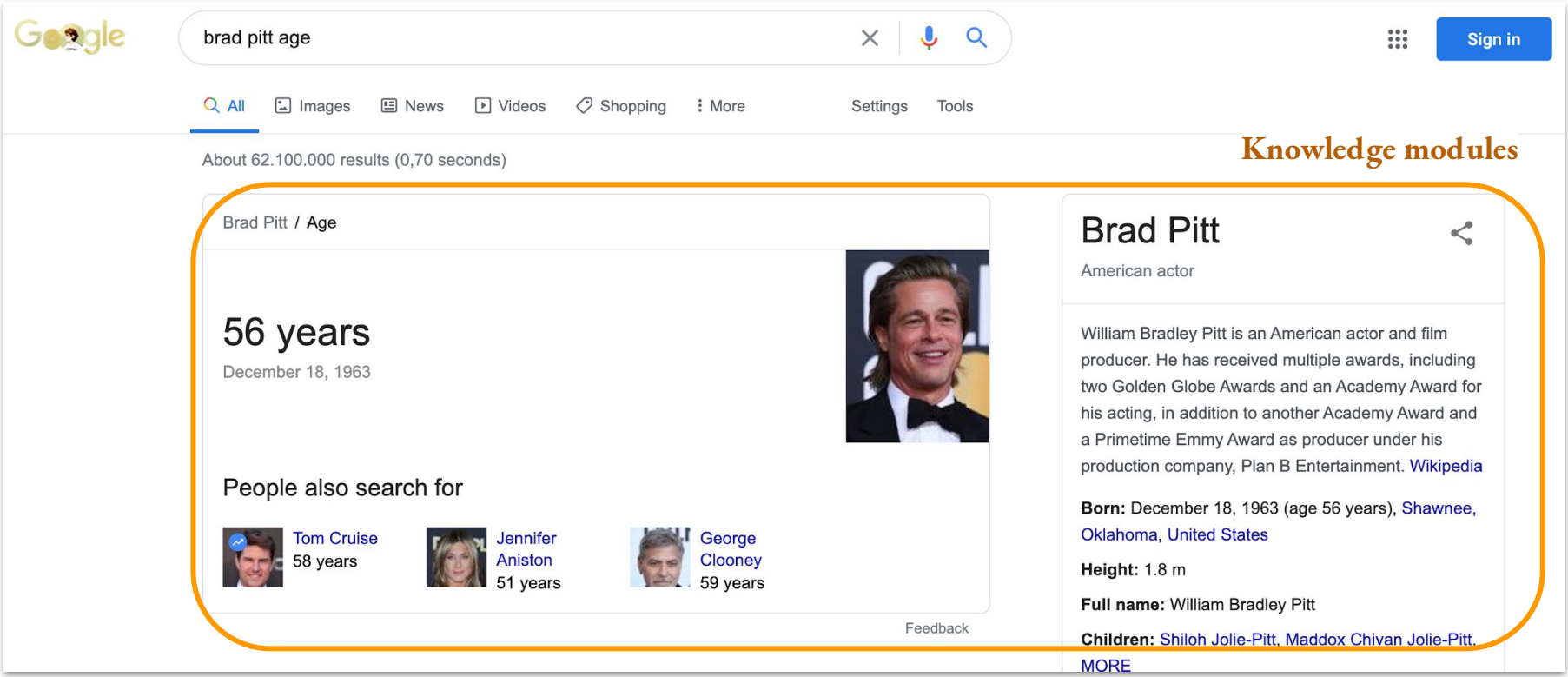
Paper: https://doi.org/10.1145/3340531.3412126 | Code: https://github.com/luksurious/abandonment-rnn

Less than half of Google Searches result in a click

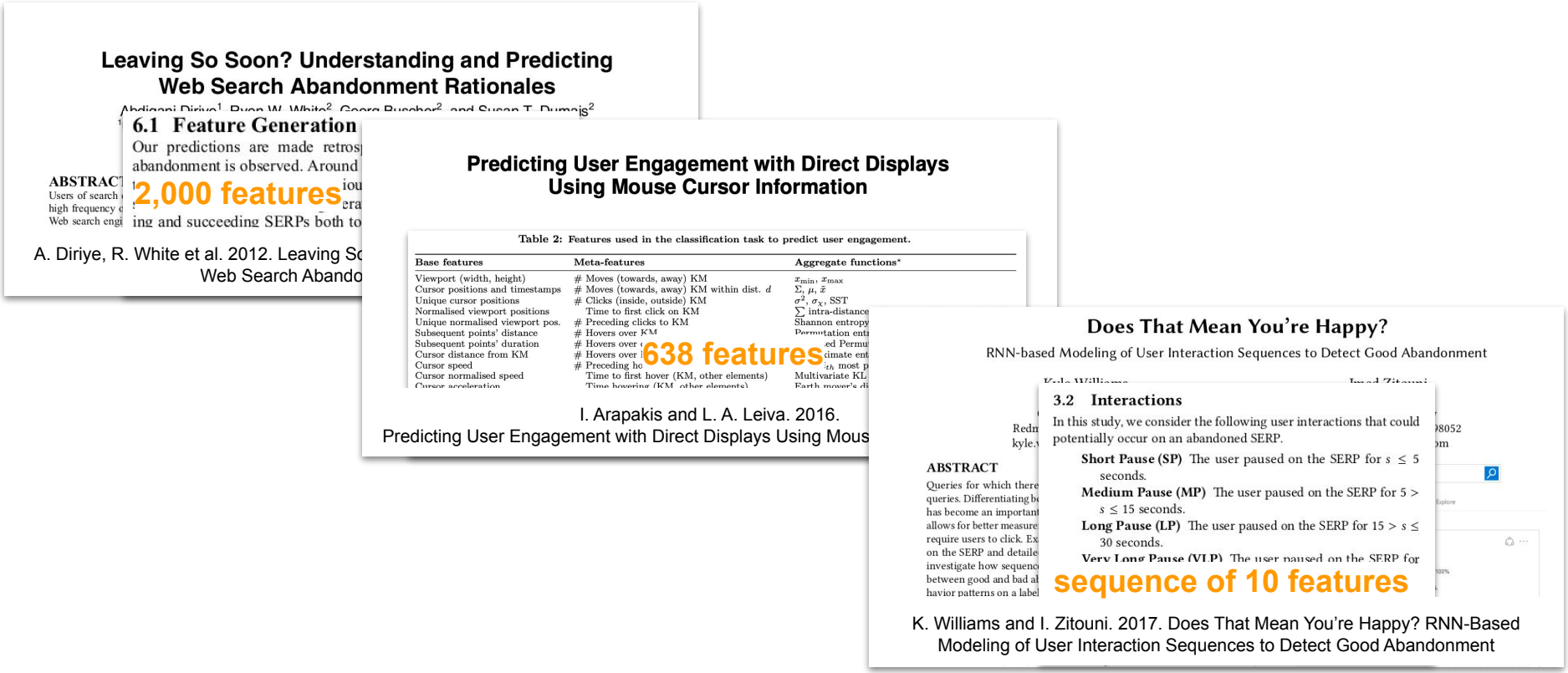


Source: https://sparktoro.com/blog/less-than-half-of-google-searches-now-result-in-a-click/

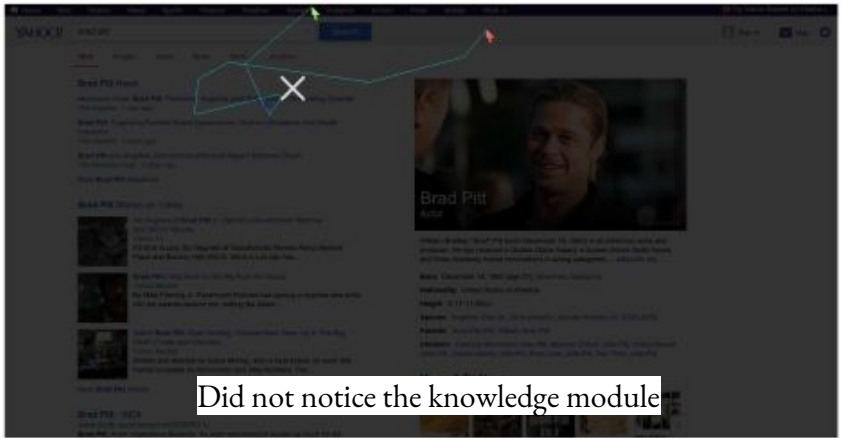
“Good” query abandonment



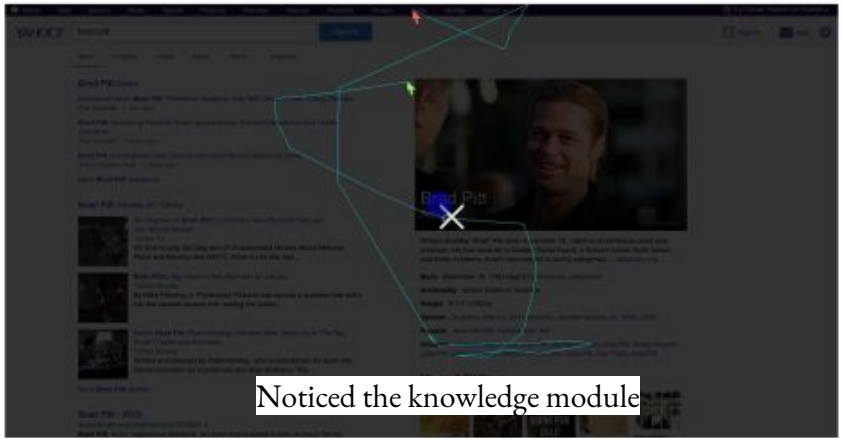
Previous work relied on engineered features



Mouse Movements allow to understand user behavior*



Did not notice the knowledge module

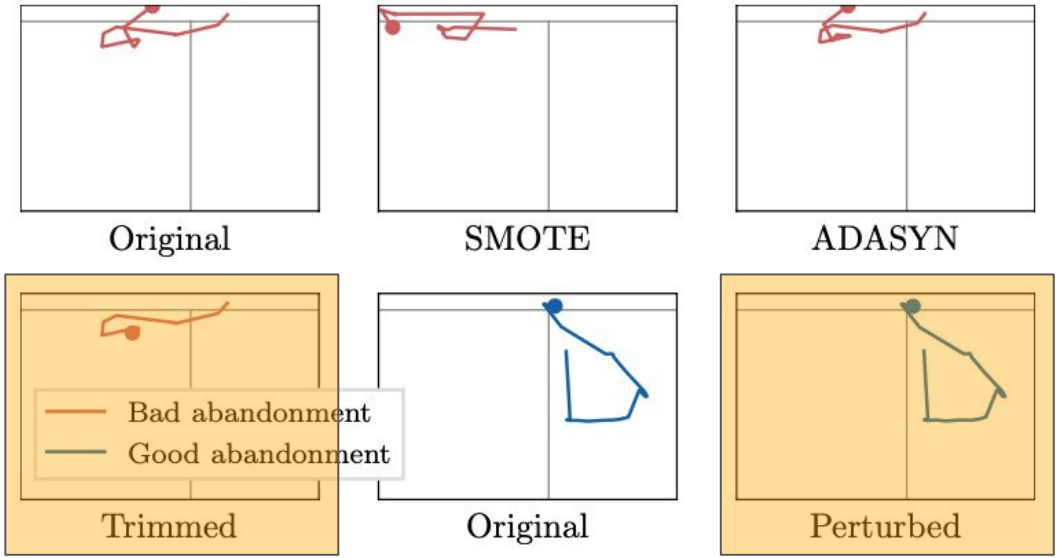


Noticed the knowledge module

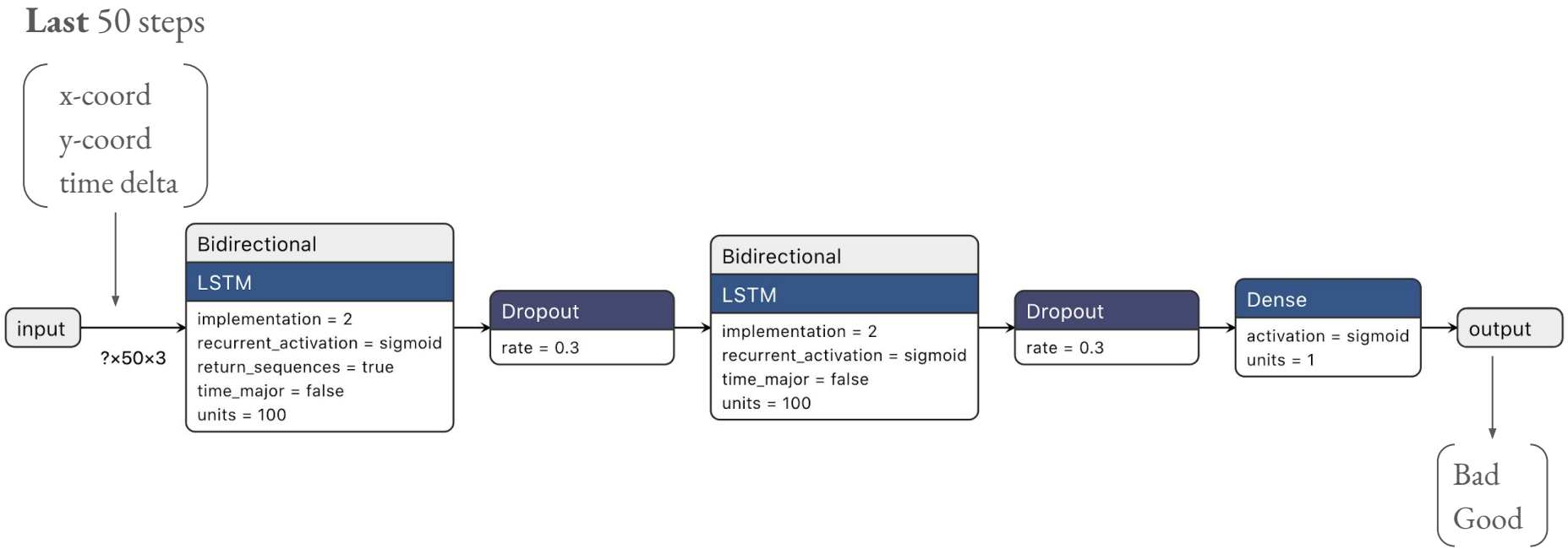
→ No need for expensive, handcrafted features

* J. Huang et al. 2011. No Clicks, No Problem: Using Cursor Movements to Understand and Improve Search

Domain-specific data augmentation helps prediction



Binary Classification with BiLSTM Model



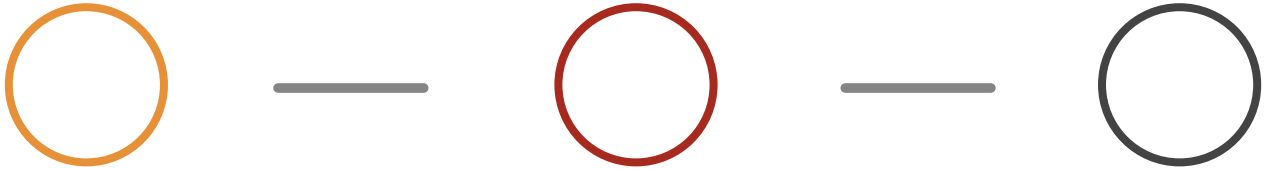
Highest ROC AUC with custom augmentation

Input data	Time	Augmentation	Adj. Precision	Adj. Recall	F-measure	ROC AUC
All abandoned queries are considered bad abandonments			0.08 [0.06, 0.11]	0.28 [0.24, 0.32]	0.12 [0.10, 0.15]	0.50 [0.50, 0.50]
RF using 10-dim feat vectors		ADASYN	0.67 [0.58, 0.76]	0.64 [0.54, 0.73]	0.64 [0.54, 0.73]	0.60 [0.50, 0.69]
XGB using 10-dim feat vectors		ADASYN	0.70 [0.60, 0.78]	0.65 [0.55, 0.74]	**0.65** [0.55, 0.74]	0.61 [0.51, 0.70]
Standardized coords	no	none	0.52 [0.48, 0.57]	**0.72** [0.68, 0.76]	0.60 [0.56, 0.65]	0.50 [0.46, 0.55]
Raw coords	yes	rand. undersample	0.68 [0.64, 0.72]	0.59 [0.54, 0.63]	0.59 [0.54, 0.63]	0.59 [0.54, 0.63]
Standardized coords	yes	rand. oversample	0.67 [0.62, 0.71]	0.63 [0.58, 0.67]	0.62 [0.57, 0.66]	0.59 [0.54, 0.63]
Speed only	implied	SMOTE	0.67 [0.63, 0.71]	0.63 [0.58, 0.67]	0.63 [0.58, 0.67]	0.59 [0.55, 0.63]
Speed + distance to KM	implied	SMOTE	0.70 [0.65, 0.73]	0.65 [0.61, 0.69]	**0.65** [0.61, 0.69]	0.61 [0.57, 0.65]
Raw coords	yes	SMOTE	0.69 [0.65, 0.73]	0.63 [0.59, 0.67]	0.63 [0.59, 0.68]	0.61 [0.57, 0.65]
Standardized coords	yes	ADASYN	0.68 [0.64, 0.72]	0.64 [0.60, 0.68]	0.64 [0.59, 0.68]	0.61 [0.56, 0.65]
Standardized coords	yes	distortion or trimming	**0.72** [0.68, 0.76]	0.65 [0.61, 0.69]	**0.65** [0.61, 0.69]	**0.63** [0.59, 0.68]

Table 1: Experiment results. Top rows are baseline conditions. We report the best combination of {Coords, Time, Resampling, Augmentation} techniques tested (36 in total). 95% conf. intervals according to the Wilson method for binomial distributions.

→ Slightly improving on baselines based on engineered features of previous work

Discussion



Targeted Models

Commercial providers might want to ensure only bad abandonments are investigated

Limitation

Data set with small sample size

Practical

Mouse movements for abandoned queries complement click-based metrics for SERPs

Thank you for your attention

This presentation was supported by the **SIGIR Student Travel Grant**

Slides: https://github.com/luksurious/abandonment-rnn/presentation-cikm.pdf
Code: https://github.com/luksurious/abandonment-rnn

Talk to us on Twitter: @luksurious @iarapakis @luileito
Contact: lukas@lukas-brueckner.de