APPENDIX. MULTIMODAL USER DATA

Data modality	Feature category	Feature	References
Online search behavior	Query	Query length	Hirsch et al., 2020; Azzopardi, 2011; Shen et al., 2005; White et al., 2006; Liu & Han, 2020; Palani et al., 2020
		Average query length per task	Palani et al., 2020
		Number of unique queries	O'Brien et al., 2020
		Number of unique query terms	O'Brien et al., 2020; Liu & Han, 2020
		Term overlap occurrence	White et al., 2006
		Repeated queries	Lu et al., 2020
		Errors per query	Palani et al., 2020
		Number of spelling errors in query	Makri et al., 2006; Palani et al., 2020
		Search query spelling/ syntax altering	Makri et al., 2006
		Time spent issuing queries	Kelly & Azzopardi, 2015; Orso et al., 2017
		Number of queries	O'Brien et al., 2020; Hirsch et al., 2020; Koenemann & Belkin, 1996; Kucukyilmaz, 2021; Lu et al., 2020; Palani et al., 2020; Shen et al., 2005; Arguello et al., 2012; White et al., 2006; Wicaksono & Moffat, 2021; Liu & Han, 2020; Azzopardi, 2011;
		Average number of queries	Azzopardi, 2011
		Abandoned queries	O'Brien et al., 2020
		Number of queries without a mouseover event	O'Brien et al., 2020; Liu & Han, 2020
		Number of queries without a scroll event	O'Brien et al., 2020; Joachims et al., 2007
		Number of quick query reformulations	O'Brien et al., 2020
	Click and mouseover	Click-through rate	Wicaksono & Moffat, 2021; Hirsch et al., 2020; Shen et al., 2005
		Frequency to consult additional information pages	Orso et al., 2017; Wicaksono & Moffat, 2021
		Abandoned clicks	O'Brien et al., 2020
		Number of SERP clicked	Arguello et al., 2012; Wicaksono & Moffat, 2021

		Average rank of clicks	Liu & Han, 2020; Lorigo et al., 2006
		Median rank of clicks	Hirsch et al., 2020
		Number of clicks between ranks 1-3	Liu & Han, 2020
		Number of clicks between ranks 1-5	Liu & Han, 2020
		Number of clicks below rank 5	Liu & Han, 2020
		Deepest SERP click	Kelly & Azzopardi, 2015
		Time to the last click	Liu & Han, 2020
		Time to the first click	Liu & Han, 2020; O'Brien et al., 2020
		Percentage of reversed actions	White et al., 2006
		Average number of actions performed	White et al., 2006; Liu & Han, 2020
	Visit	Average numbers of SERP viewed	Lorigo et al., 2006
		Number of SERP visited	Palani et al., 2020; Kelly & Azzopardi, 2015
		Number of content pages Visited	Liu & Han, 2020; Wu et al., 2019a; Kelly & Azzopardi, 2015
		Number of URLs visited	Arguello et al., 2012; Baskaya et al., 2013
	Dwell time	Total time spent on content pages	Liu & Han, 2020
		Average time spent on content pages	Liu & Han, 2020
		Average time spent viewing documents	Lorigo et al., 2006; Wicaksono & Moffat, 2021
		Total time spent viewing documents	Wicaksono & Moffat, 2021; Kelly & Azzopardi, 2015
		Average time spent on content pages	Lorigo et al., 2006
		Total time spent on result pages	Liu & Han, 2020
		Percent time spent on SERP	Lorigo et al., 2006
		Average time spent on SERP	Kelly & Azzopardi, 2015
		Query dwell time	Liu & Han, 2020; Belkin et al., 2001
		Average query dwell time	O'Brien et al., 2020
		Session length	Wicaksono & Moffat, 2021; Liu & Han, 2020; Borlund, 2003; O'Brien et al., 2020; Su, 1992
	Usefulness	Number of documents saved	Belkin et al., 2001

	judgement	Number of bookmarks	O'Brien et al., 2020
		Average bookmark rank	O'Brien et al., 2020
		Time to first bookmark	O'Brien et al., 2020
Eye movement	Fixation	First fixation AOI	Hilberink-Schulpen et al., 2016
		First fixation duration	Bera & Poels, 2019; Liu et al., 2020; Gudinavičius & Šuminas, 2018; Rubin & Beuk, 2021; Wu et al., 2021
		Last fixation AOI	Liu et al., 2020; Kim et al., 2015
		Last fixation duration	Liu et al., 2020
		Slope between two fixations	Wu et al., 2019b
		Number of fixations before first arrival	John et al., 2017
		Time to (the) first fixation	Tourassi et al., 2013; Syn & Yoon, 2021; Lueck, 2017; Djamasbi et al., 2012; Wu & Zhang, 2020; Porta et al., 2013; John et al., 2017
		Time for First Fixation	Bera & Poels, 2019; Liu et al., 2020; Gudinavičius & Šuminas, 2018; Rubin & Beuk, 2021; Wu et al., 2021
		Fixation duration on SERPs	Bilal & Gwizdka, 2016; Cole et al., 2011; Wu & Zhang, 2020; Sachse, 2019; Jiang et al., 2014; Voos et al., 2013; Proudfoot et al., 2016
		Average fixation duration on each AOI	Wu & Xu, 2019; Wang et al., 2020; Chae & Lee, 2013; John et al., 2017; Rubin & Beuk, 2021; Boisvert & Bruce, 2016; Xie et al., 2021; Ooms et al., 2012; Wu et al, 2020a; Stange et al, 2018; Jaeger & Eckhardt, 2021; Porta et al, 2013; Kim et al, 2016; Zheng et al, 2020; Kim et al, 2015; Liu & Shen, 2011
		Total duration of fixation on each AOI	Wu & Xu, 2019; Gwizdka et al., 2017; Alahmadi et al., 2019; John et al., 2017; Lueck, 2017; Saparova & Nolan, 2016; Porta et al., 2013; Mackert et al., 2013; John et al., 2017; Bol et al., 2016; Hong et al., 2021; Cole et al., 2011; Bera et al., 2019; Golebiowska et al., 2017; Wang et al., 2020; Palani et al., 2020; Wu et al., 2021; Wang et al., 2016; Neuert, 2020; Stange et al., 2018; Lagun et al., 2014; Cole et al., 2013; Ellison et

			al., 2020; Cole et al., 2014; Luan et al., 2018; Chae & Lee, 2013; Qu et al., 2017; Xu & Zhang, 2019; Vance et al., 2018; Dunaway et al., 2018; Anderson et al., 2016; Turner et al., 2014; Fu et al., 2020; Han et al., 2020
		Total fixation duration on AOIs	Ye et al., 2020
		Fixation for each task	Kim et al., 2015
		Total duration time	Ye et al., 2020
		Revisited fixation duration	Lin et al., 2019
		Proportion duration of fixation for each AOI	Hilberink-Schulpen et al., 2016; Boisvert & Bruce, 2016; Lagun et al., 2014; Wu & Zhang, 2020; Cheung et al., 2017; Wu & Xu, 2019; Neuert, 2020; John et al., 2017; Twyman et al., 2014; Wang et al., 2020
		Travel time	Wu et al., 2019b
		Peak duration	Ye et al., 2020
		Fixation counts on each AOI	Saparova & Nolan, 2016; Wang et al., 2016; Ye et al., 2020; Lenzner et al., 2014; Meister & Buffalo, 2016; Boisvert & Bruce, 2016; Al-Samarraie et al., 2017; Liao et al., 2019; Marchionini & Mu, 2003; John et al., 2017; Luan et al., 2018; Vance et al., 2018; Qu et al., 2017; Lueck, 2017
		Time for First Fixation	Bera & Poels, 2019; Liu et al., 2020; Gudinavičius & Šuminas, 2018; Rubin & Beuk, 2021; Wu et al., 2021
		Fixation duration on SERPs	Bilal & Gwizdka, 2016; Cole et al., 2011; Wu & Zhang, 2020; Sachse, 2019; Jiang et al., 2014; Voos et al., 2013; Proudfoot et al., 2016

		Average fixation duration on each AOI	Wu & Xu, 2019; Wang et al., 2020; Chae & Lee, 2013; John et al., 2017; Rubin & Beuk, 2021; Boisvert & Bruce, 2016; Xie et al., 2021; Ooms et al., 2012; Wu et al, 2020a; Stange et al, 2018; Jaeger & Eckhardt, 2021; Porta et al, 2013; Kim et al, 2016; Zheng et al, 2020; Kim et al, 2015; Liu & Shen, 2011
		Total duration of fixation on each AOI	Wu & Xu, 2019; Gwizdka et al., 2017; Alahmadi et al., 2019; John et al., 2017; Lueck, 2017; Saparova & Nolan, 2016; Porta et al., 2013; Mackert et al., 2013; John et al., 2017; Bol et al., 2016; Hong et al., 2021; Cole et al., 2011; Bera et al., 2019; Golebiowska et al., 2017; Wang et al., 2020; Palani et al., 2020; Wu et al., 2021; Wang et al., 2016; Neuert, 2020; Stange et al., 2018; Lagun et al., 2014; Cole et al., 2013; Ellison et al., 2020; Cole et al., 2014; Luan et al., 2018; Chae & Lee, 2013; Qu et al., 2017; Xu & Zhang, 2019; Vance et al., 2018; Dunaway et al., 2018; Anderson et al., 2016; Turner et al., 2014; Fu et al., 2020; Han et al., 2020
		Total fixation duration on AOIs	Ye et al., 2020
		Fixation for each task	Kim et al., 2015
		Total duration time	Ye et al., 2020
		Revisited fixation duration	Lin et al., 2019
		Proportion duration of fixation for each AOI	Hilberink-Schulpen et al., 2016; Boisvert & Bruce, 2016; Lagun et al., 2014; Wu & Zhang, 2020; Cheung et al., 2017; Wu & Xu, 2019; Neuert, 2020; John et al., 2017; Twyman et al., 2014; Wang et al., 2020
		Travel time	Wu et al., 2019b
		Peak duration	Ye et al., 2020
		Fixation counts on each AOI	Saparova & Nolan, 2016; Wang et al., 2016; Ye et al., 2020; Lenzner et al., 2014; Meister & Buffalo, 2016; Boisvert & Bruce, 2016; Al-Samarraie et al., 2017; Liao et al.,

			2019; Marchionini & Mu, 2003; John et al., 2017; Luan et al., 2018; Vance et al., 2018; Qu et al., 2017; Lueck, 2017
	Saccade	Saccade duration	Al-Samarraie et al., 2017; Liao et al., 2019; Giannakos et al., 2019
		Average saccade duration(ms)	Liu & Shen, 2011
		Total saccade duration	Sun, 2020
		Saccade distance	Gwizdka et al., 2017; Giannakos et al., 2019
		Total saccade distance	Gwizdka et al., 2017; Wu & Xu, 2019
		Average saccade distance	Gwizdka et al., 2017; Wu & Xu, 2019
		Saccade amplitude	Giannakos et al., 2019; Liao et al., 2019; Al-Samarraie et al., 2017
		Total saccade amplitude	Liao et al., 2019
		Average saccade amplitude	Ye et al., 2020; Boisvert & Bruce, 2016
		Saccade velocity	Giannakos et al., 2019; Liao et al., 2019
		Saccade latency	Liao et al., 2019
	Pupil	Average pupil size	Al-Samarraie et al., 2017; Meister & Buffalo, 2016; Liao et al., 2019; Ye et al., 2020; Oliveira et al. 2009; Pengnate, 2019; Wang et al., 2020; Proudfoot et al., 2016; Gwizdka et al., 2017
		Maximum pupil size	Ye et al., 2020; Neuert, 2020; Saparova & Nolan, 2016
		Minimum pupil size	Ye et al., 2020; Saparova & Nolan, 2016
Facial expression	Happiness		Arapakis et al., 2009; Tkalčič et al., 2012; Zanganeh & Hariri, 2018
	Sadness		
	Ange		
	Fear		
	Disgust		
	Surprose		
	Neutral		
Verbal commentary	Topics		Munting & Taylor, 2018; Hinostroza et al., 2018

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