

Quantified Learning by Deeply Sensing Learner's Behavior

July 11, 2018

Koichi Kise Osaka Prefecture Univ.

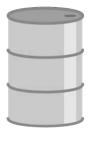
Olivier Augereau Osaka Prefecture Univ.





Resources















Natural

Money

Goods

Work

free market such as Mercari crowdworks



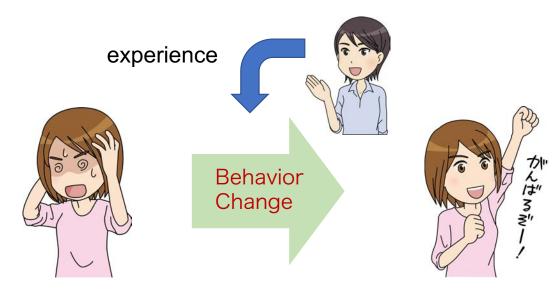
anything unexplored?



Experience as Resource



- Big data fuels artificial intelligence
- Experience fuels natural intelligence
- Can be generated only by humans
 - cannot be generated by AI



Experiential Supplements

information produced from experiences

Research Issues

How to sense

How to produce

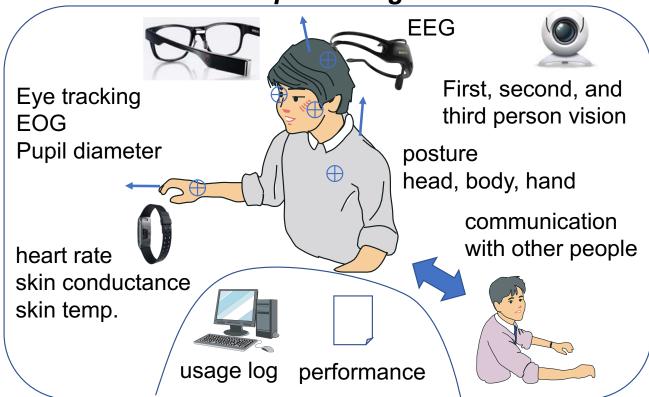
How to apply



Shallow vs. Deep Sensing



Deep Sensing E-learning systems in the future



Shallow Sensing

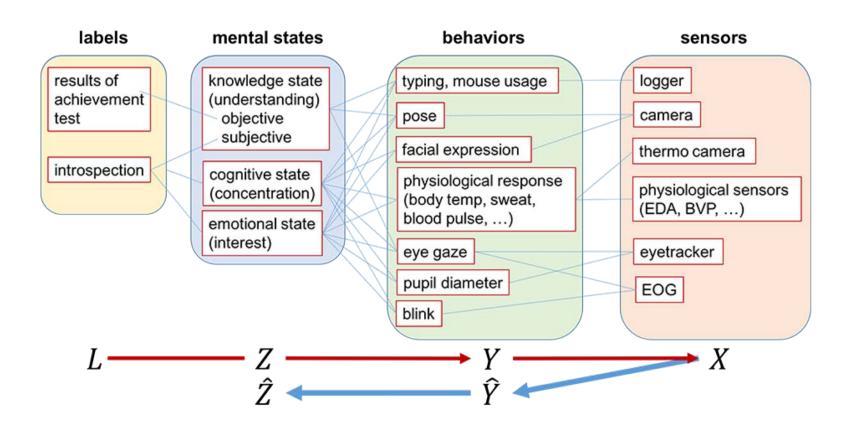
Current e-learning systems

2018/1/16



Deep Sensing Framework





2018/1/16





How to sense the learning experience?

Cognitive activity and internal states

->Physical and physiological sensing



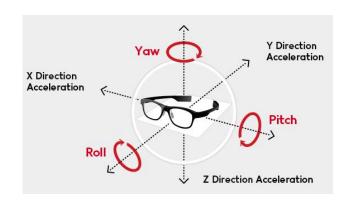
Physical: concentration, interest

Keystrokes

Accelerometer & gyroscope

Seat pressure









Physiological: stress, confidence...

BVP, EDA...



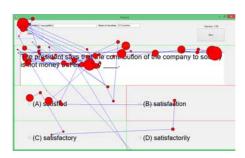






Eye tracking





Thermographic camera







Applications









Estimating the confidence based on keystrokes



Experiment: 12 participants x 120 questions

Validation	Classifier	Accuracy [%]
baseline		62.27
user-independent	SVM	89.10

Takanori Maruichi, OPU

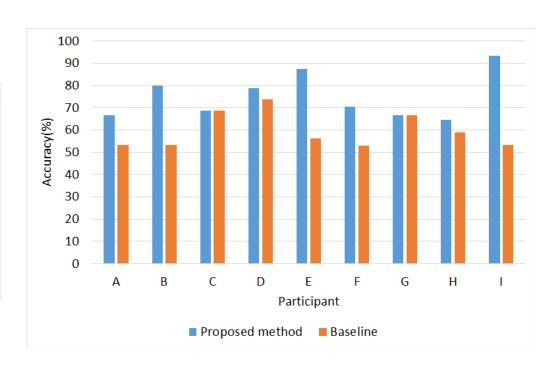




Estimating the engagement with a seat pressure sensor



													-			-
Y00	29	53	49	59	42						47	68	44	49	31	L
Y01	48	62	54	54	44	24				28	51	60	46	49	38	
Y02	52	64	57	54	48	31				38	54	54	50	50	40	
Y03	48	59	56	57	53	39				42	59	57	54	51	39	
Y04	48	56	57	58	54	43			22	44	62	59	55	50	37	
Y05	51	58	61	62	57	48			30	48	61	62	56	49	37	
Y06	55	65	68	67	64	56	25		34	53	60	62	58	51	38	
Y07	59	69	76	78	74	64	32	22	45	59	63	64	60	53	40	
Y08	63	72	81	87	87	80	47	36	59	69	71	70	64	56	41	l
Y09	54	66	80	96	108	97	72	58	80	90	86	74	68	58	43	
Y10	47	62	82	122	154	106	69	63	81	101	89	74	65	55	38	
Y11	42	54	75	123	142	95	58	56	75	100	92	73	60	48	28	
Y12	28	45	59	79	87	74	50	50	66	78	77	64	51	36		
Y13		34	46	55	58	58	47	47	55	57	55	49	41	26		
Y14			29	39	43	46	41	39	47	45	42	38				
Y15				25	34	29	20	20	29	35	28	26				



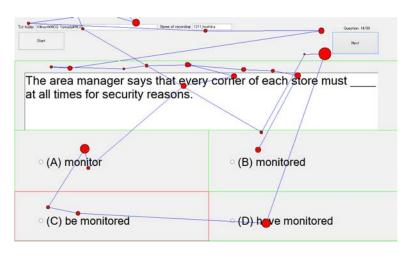
Kazuaki Nomura, OPU

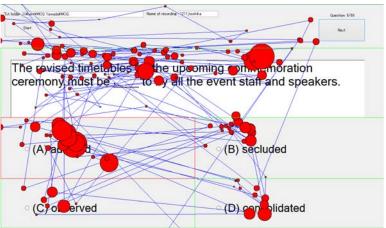




Estimating the confidence with an eye tracker

	Confident	Unconfident
Correct	⊕ Good!	⊕ Luck?
Incorrect	⊗ Misconception?	⊕ Revise!







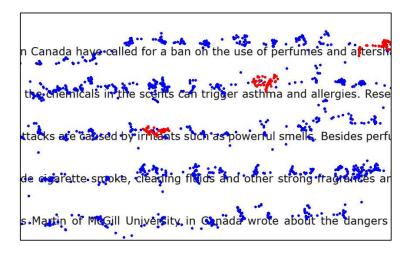


Estimating the understanding with an eye tracker





Subjective and objective understanding

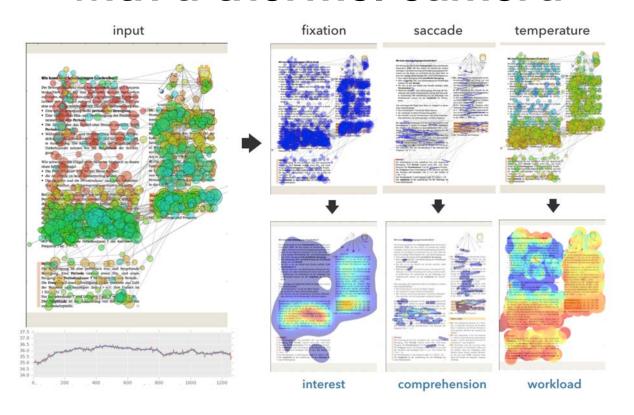


Predicting difficult words





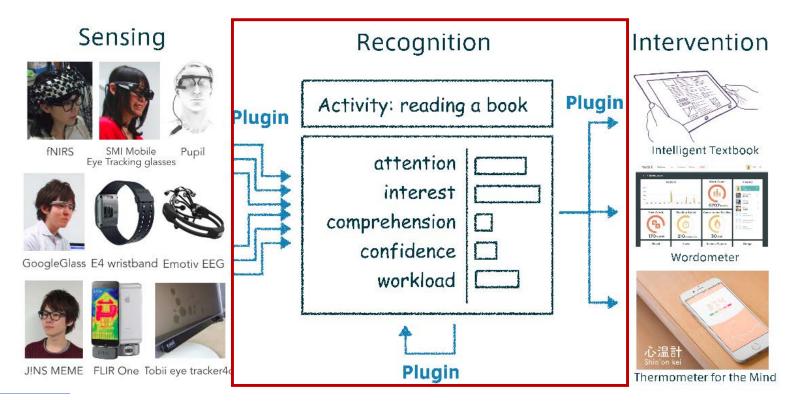
Estimating the mental workload with a thermo. camera







Machine-in-the-loop to assist students



Shoya Ishimaru, DFKI



Quantified Learning by Deeply Sensing Learner's Behavior

July 11, 2018

Koichi Kise Osaka Prefecture Univ.

Olivier Augereau Osaka Prefecture Univ.

