



COMPUTATIONAL BEHAVIOR MODELING

RESEARCH METHOD



WHAT IS GOOD RESEARCH?

- How do I know this article is methodological sound?
- Are the findings practically meaningful
 - Statistical versus practical significance
- Design of research is a compromise
 - Use best possible methods
 - Avoid as many confound or other interpretations of you data
- Look for convergence among research methods

RESEARCH METHOD

- What approaches do scientists use to measure behavior modeling?
- What specific designs are unique to behavior modeling research?
- What are general designs for doing research?

CONDUCTING RESEARCH ETHICALLY

- Collaborative Research Training Initiative
- Institutional Review Board (IRB)
- Informed Consent

RELIABILITY & VALIDITY OF MEASURES

- Choice of outcome measures is important.
- Reliability of a measure: extent to which it provides a consistent index of the behavior of interest (*measurement error*).
- Validity of a measure: extent to which it measures what researchers think it measures.

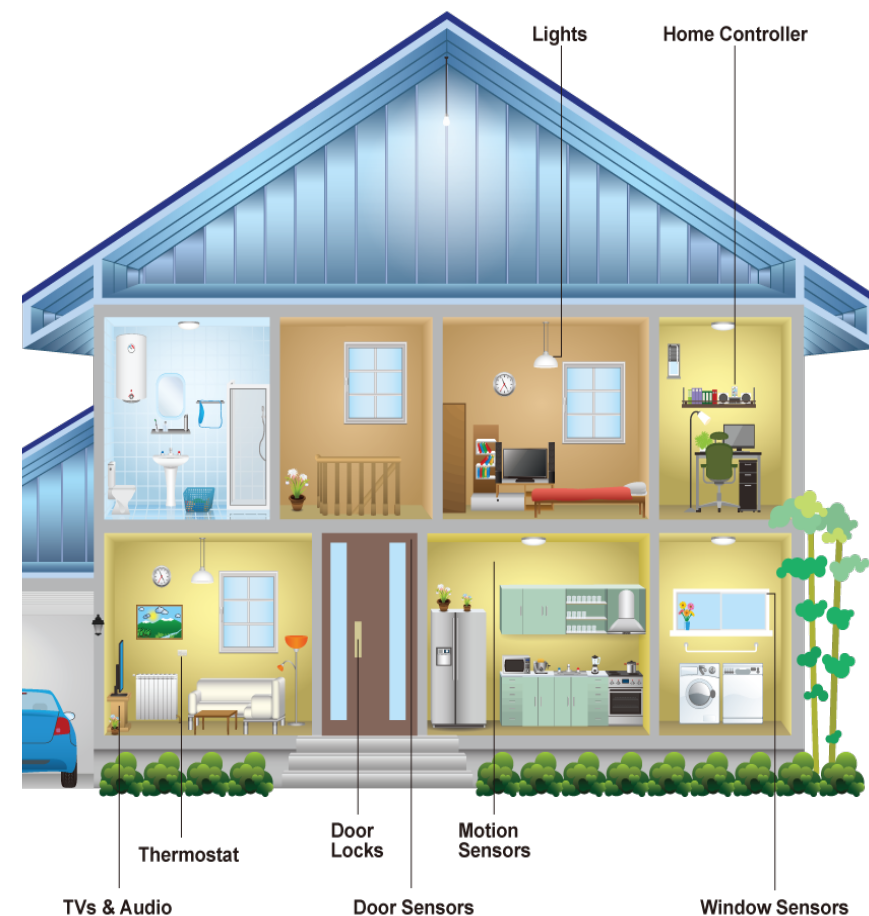
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EXAMPLE

■ Data from smart watch

2016-04-01 12:39:44.825323 MainEntryway OFF Other_Activity
2016-04-01 12:40:20.932096 BathroomASink ON Take_Medicine
2016-04-01 12:40:21.219997 BedroomABed ON Relax
2016-04-01 12:40:22.435275 MainEntryway ON Other_Activity
2016-04-01 12:40:23.53145 MainEntryway OFF Other_Activity
2016-04-01 12:40:23.62437 BedroomABed OFF Relax
2016-04-01 12:40:25.521123 BedroomABed ON Relax
2016-04-01 12:40:26.099618 BathroomASink OFF Bed_Toilet_Transition
2016-04-01 12:40:26.532888 MainEntryway OFF Other_Activity
2016-04-01 12:40:29.812875 BedroomABed OFF Relax
2016-04-01 12:40:30.058532 BathroomAArea OFF Bed_Toilet_Transition
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2016-04-01 12:40:31.820019 BedroomDArea OFF Relax
2016-04-01 12:40:35.434451 BedroomABed OFF Relax
2016-04-01 12:40:38.343873 EntrywayB OFF Other_Activity



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- Questions:

- Data Collection
 - Approval from IRB
- Activity recognition
- Measure choice
- Feature extraction

EXAMPLE

- Questionnaire Design
 - The time to get up
 - The time to eat breakfast
 - The time to start work
 - The time to go to bed

Resident Lifestyle Survey

Please complete the survey to enable us to improve your lifestyles.

Name: (optional).....

Date:.....

1 – Leisure <u>Interests</u> & Activities	Yes	No	Feedback
Are you aware of our daily activities in the recreation area?			
Do you get a monthly copy of our 'Activity Calendar'?			
Is your input on activities sought in the monthly 'Residents' Meeting'?			
Would you like any of our activities to be more frequent?			
Are you satisfied with our community outings?			
Do you have a favourite activity? <u>E.g.</u> gardening, massage.			
Are you encouraged by staff to participate in activities?			
Is your family/primary carer encouraged to accompany you on community outings as a volunteer?			

EXAMPLE

■ Measures

■ Activity recognition measures:

- Accuracy
- p-value of t-test
- F1 score

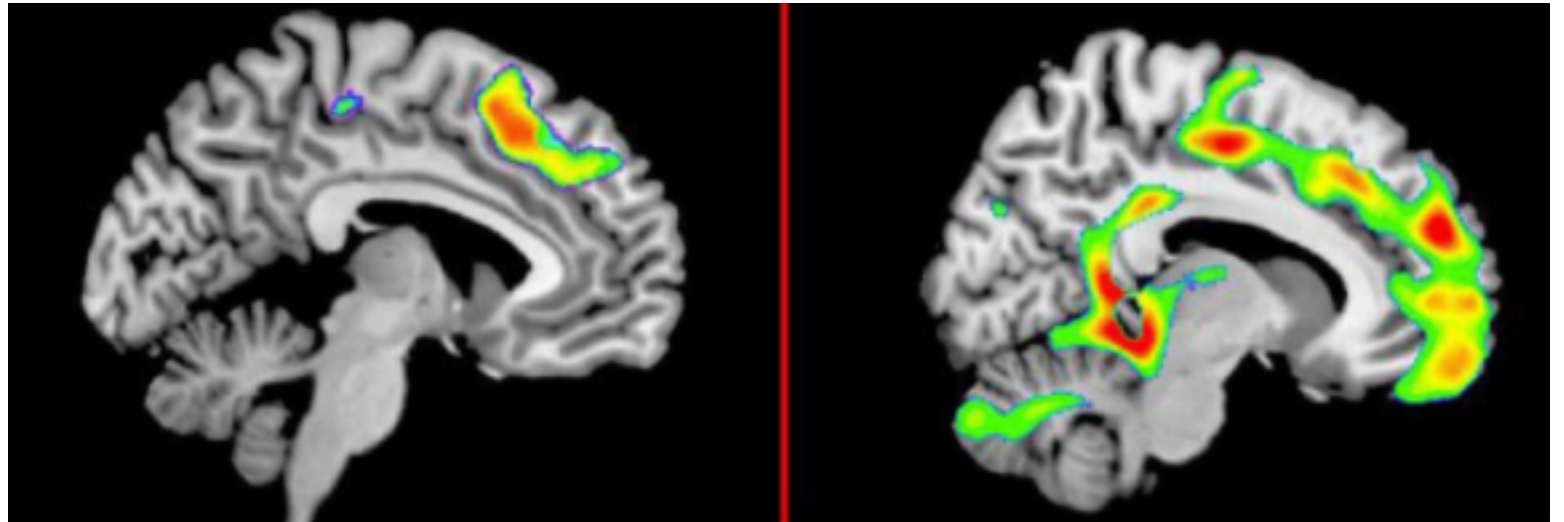
		Real	
		Positive	Negative
Predicted	Positive	1	2
	Negative	0	7

$$\text{precision} = \frac{tp}{tp + fp} = \frac{1}{3} = 33\%$$
$$\text{recall} = \frac{tp}{tp + fn} = \frac{1}{1} = 100\%$$

$$F_1 = 2 * \frac{\text{precision} * \text{recall}}{\text{precision} + \text{recall}}$$

EXAMPLE

- Measures
 - To distinguish between diagnostic groups



EXAMPLE

- Feature Extraction

- Temporal

- Duration

- Frequency

- Distance

- ...

- Spatial

- Location

- Transition between locations

- ...

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BEHAVIOR MODELING PROGRAMS

- Modeling
 - Traffic
 - Crowd Flow
 - Home/Building/City
 - Nature
 - Health



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