Week 3: Constructive Research Problems

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TIM-7241:Constructive Research Design

May 9, 2021

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# Constructive Research Problems

For this assignment, examine three constructive research studies published in peer-reviewed journals to evaluate the alignment of the research questions to the research problem and purpose.

Table 1: Outline of Constructive Research Papers

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| --- | --- | --- | --- |
|  | E-Cig (2021) | Electric Distr. (2021) | Power People (2018) |
| Problem | Regulating electronic cigarettes – 29% of Indonesia smokes | Forecasting failures in electric power grids | Indian Villagers have low adoption rates of Prepaid electric |
| Questions | 1. Are people for/against regulation? 2. What reasons | 1. How can we use NoSQL stores to centralize data from heterogeneous sensors 2. Can we build a forecasting model to predict reliability issues | 1. Why aren’t they using the service 2. Are there design changes to promote engagement |
| Design | 1. Collect Tweets 2. Apply clustering algorithms 3. Compare the performance | 1. Collect and simulate different usage requirements. 2. Build a forecasting model 3. Assess performance using historical data | 1. Build disposable prototype 2. Iterate with rural Indians 3. Assess the suitability of the system |
| Study Purpose | Understand the impact of increased taxes and marketing | Improve efficiencies in the spot market and reduce customer costs | Prepaid electric business models require “enough” customers to be sustainable |
| Conclusions | 1. The classifier reliably detects e-cig preferences. 2. Improvements exist across demographic tags, resampling, only uses Twitter | 1. The discharge model saves 2.5% daily ($10k on 375k) 2. Deploying more broadly would be desirable | 1. Technical details were confusing 2. Most rural people cannot read English 3. Including the balance on the home screen was most useful |

# Analyzing E-Cigarette Conversations on Twitter (2021)

## Problem

Indonesia has one of the highest smoking populations (28.9%). Regulators and lobbyists have concerns that e-cigarettes (e-cigs) will increase this value and create burdens on its public health care system. They need to understand the population’s perspective on the safety, taxation, and regulation of e-cigs.

## Approach

Kaunag et al. (2021) approach this problem by training classification models with 8079 tweets discussing vaping (e.g., Favor or Against smoking). Each tweet goes through a pre-processing pipeline to remove punctuation, duplicate words, and common keywords (e.g., lol). After cleaning, the messages are tagged and clustered. Finally, they tease out the user’s decision rationale using topic modeling (e.g., NMF and LDA).

## Conclusion

The authors deliver a process for analyzing e-cig sentiment and rationale from a corpus of tweets. These insights enable regulators to track changes in public opinion and design more effective marketing campaigns. For instance, when Muhammadiyah fatwa approved e-cigs usage, an enormous supporters spike occurred. Future efforts could also consider demographic information or consider additional social media sources.

# CPS Applications with Case Study of Intelligent Dispatch of PV (2021)

## Problem

Distributed energy grids encounter intermittent failures, causing service disruptions in the availability of electricity for customers. Smart grids mitigate these issues with battery backup systems that collect and discharge energy as necessary. Like other commodities, electricity has a variable spot price that reacts to supply and demand changes. Power companies need to forecast these disruptions and charge their batteries before the prices jump. It is challenging to build these predictive capabilities due to the limited standardization of sensor data.

## Approach