Research Methods in computer science

Spring 2023

Lecture 5

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February 1, 2023

Agenda

Research and Startups

Anatomy of Research Papers

HW2

Parallels to Products

Research can be thought of as a Product

Product Viability Evaluation

Companies do this all the time

Lets look at some examples

Viabilty of Product Idea

1. What is the potential market size or demand?

2. Who are your competitors?

3. Is it a trend, fad, flat or growing market?

5. Who are your target customers?

6. What is your potential selling price?

https://www.shopify.com/blog/13640265-the-16-step-guide-to-evaluating-the-viability-of-any-product-idea

Research vs Startups

What should you work on? Are you working on the right problem?

MVP.

Usually resource constrained and must prioritize.

Small team.

Selling process.

Marketing.

(Thanks to Guo)

Research Papers

Understanding what papers look like

Anatomy of a Research Paper

Abstract

Introduction

Related Work

Design and Implementation

Evaluation

Conclusion

Some of the contents in the next few slides from Jennifer Widom's notes on Writing Technical Papers.

Abstract

Summary of motivation, state of the art, your algorithm or system, and results each in 1-3 sentences.

Abstract MadLibs!!

This paper presents a _____ method for _____
(synonym for *new*) (sciencey verb)
the _____. Using _____, the
(noun few people have heard of) (something you didn't invent)
_____ was measured to be _____ +/- _____
(property) (number) (number)
_____. Results show _____ agreement with
(units) (sexy adjective)
theoretical predictions and significant improvement over
previous efforts by _____, et al. The work presented
(Loser)
here has profound implications for future studies of
_____ and may one day help solve the problem of
(buzzword)
_____.
(supreme sociological concern)

Keywords: _____, _____, _____
(buzzword) (buzzword) (buzzword)

WWW.PHDCOMICS.COM

Introduction

What is the problem?

Why is it interesting and important?

Why is it hard? (E.g., why do naive approaches fail?)

Why hasn't it been solved before? (Or, what's wrong with previous proposed solutions? How does mine differ?)

What are the key components of my approach and results? Also include any specific limitations.

Summary of results and contributions.

Related Work

You want to give a sense of the old and new work in this area.

Where to look for these?

Organized is better than not organized

Organizing Related Work

Lists

Figures

Diagrams

Tables

Sub-sections

Competition table

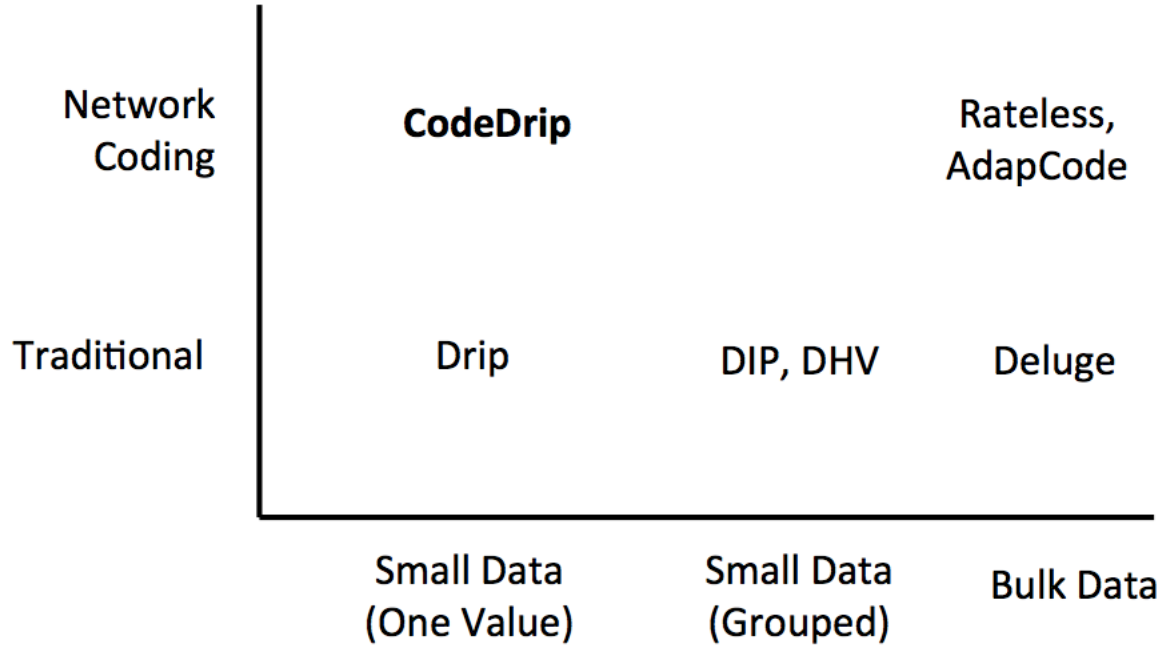

Fig. 1. Selected classes of dissemination protocols in sensor network. CodeDrip uses network coding to make dissemination of small data efficient and fast.

Table 1: Comparison of different non-intrusive people identification methods.

Paper	Sensor	Accuracy (%)	population
Hnat et al. [6]	Ultrasonic	94	5
Pan et al. [18]	Geophone	96	5
Zeng et al. [24]	Wi-Fi	93	4
Jenkins et al. [9]	Pressure	80	15
Khalil et al. [13]	Ultrasonic	95	20

Table I: State of the Art People Counting Solutions

Solution	Application	Cost ($)	Privacy Preserving Level	Scalability	Real Time	Flexibility
Break Beam Sensors	Counting	≤ 10	High	Yes	Yes	No
PIR Sensors	Presence	≤ 10	High	Yes	Yes	Yes
Ultrasonic Sensor	Counting	≤ 100	Moderate	No	Training Required	No
RGB Cameras	Counting	≤ 100	Low	Yes	Yes	No
IR Imager	Counting	≤ 25	High	Yes	Training Required	No
Our Solution	Counting	≤ 25	High	Yes	Yes	Yes

Table 1. Performance for state-of-the-art embedded VLC.

System	**Dietz et al. [13]**	**Schmid et al. [24]**	**Klaver et al.[19]**	**Wang et al. [31]**	**Hewage et al. [15]**	**Li et al. [21]**	**Our Work**
Data Rate	250 bps	800 bps	1 kbps	16 kbps	1 mbps	1-10 kbps	100 kbps
Distance	~10cm	~2m	~1m	~5m	NA	~20cm	6m
Multi-hop	No	No	Yes	No	No	No	Yes
Full-Duplex	No	No	No	No	No	No	Yes
Parallel Channels	No	No	No	No	No	No	Yes
Implementation	MCU	MCU	MCU	ARM	FPGA+MCU	MCU	ARM + PRU
Antenna	LED-to-LED	LED-to-LED	LED-to-PD	LED-to-LED/PD	LED-to-PD	RGB-to-RGB	RGB/LED-to-LED/PD

IV. Related Work

In this section, we overview the types of tools the networking community has built to evaluate network protocols.

Link Emulation: Single link emulation can be done on hardware (using channel emulators) or on software (using tools such as Netem). Prior work has shown that when correctly configured, Netem provides a realistic estimation of impaired network conditions and is sufficient for most networking experiments [15].

Network Emulation: Mininet [4] [5] uses light-weight virtualization by isolating certain OS resources, thus allowing emulation of large networks in a single machine. However, scalability becomes an issue when we want to emulate larger networks than can be tested in a single physical machine. Emulab [16] light-weight virtualization technique, FreeBSD jails, to setup multiple virtual interfaces per process group, similar to Mininet and CloudNet. CloudNet provides better resource isolation across the emulated nodes than Emulab and shows how we can use it on the commodity clouds. There is some prior work in data centers to optimize VM placement and routing [17]. CloudNet uses the concept of placement groups in Amazon EC2 where the virtual machines are placed as close to each other so that we can efficiently use the resources.

Network Emulation Timing: Time-Warp [18] explores the possibility of using time dilation in network emulation experiments. Future version of CloudNet may use this technique to offer added consistency in performance for emulations that requires very high-bandwidth. Slicetime is another effort to provide scalable and accurate network emulation [19]. Slicetime makes the simulations independent of real time constraint thus allowing simulation of complex and high performance networks when we have limited physical resources.

Competition

Template by **PitchDeckCoach**.com

Competition

$90M raised on concept of SMB loyalty in 2011 and 2012…

LevelUp, FiveStars, BellyCard, Mogl, Shopkick, etc.

Loyalty in nightlife is wide open!

	Flowtab	GOPAGO	coaster	tabbedout	bartab
Bars & Nightclubs	✓		✓	✓	✓
Multiple Cities	✓	✓		✓	✓
0% CC Processing	✓				
Distribution Partner	✓	✓			
Table Ordering	✓				
POS Integration				✓	

Related work variations

Merged with Introduction

Inter-mingled with relevant sections

Placement of Related Work

HW2 - Research Formulation

What are you trying to do? Articulate your objectives using absolutely no jargon.

How is it done today, and what are the limits of current practice?

What's new in your approach and why do you think it will be successful?

Who cares?

Heilmeier

HW2 - Research Formulation

If you're successful, what difference will it make?

What are the risks and the payoffs?

How much will it cost?

How long will it take?

What are the midterm and final "exams" to check for success?

Heilmeier