Research Methods
in computer science
Spring 2024

Lecture 7

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Agenda

Anatomy of Research Papers

HW3

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Thesis defense opens w/ "This thesis is about X. This is why we care abt X. This is why X is a hard problem." They should all start this way

♡ 25   12:27 PM - Mar 26, 2015

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👤 See 🍒 Laura Albert 🍒's other Tweets   ›

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.

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. How is your work related to what others have done?

Where to look for these?

Organized is better than not organized

What work is related?

Relation could be

    Similar problems

    Similar methods

    Applications

    Datasets

Don't go too broad

    "Computer" not a related work in ML papers

Why do we need related work?

Justify that the proposed work is needed

    Hopefully, an objective justification

Demonstrate mastery over area

    Reviewers want to know if they can trust you

Relationship to other scientific areas

      Connect the dots

      Sometimes helps non-expert reviewers

Organizing Related Work

Lists

Figures

Diagrams

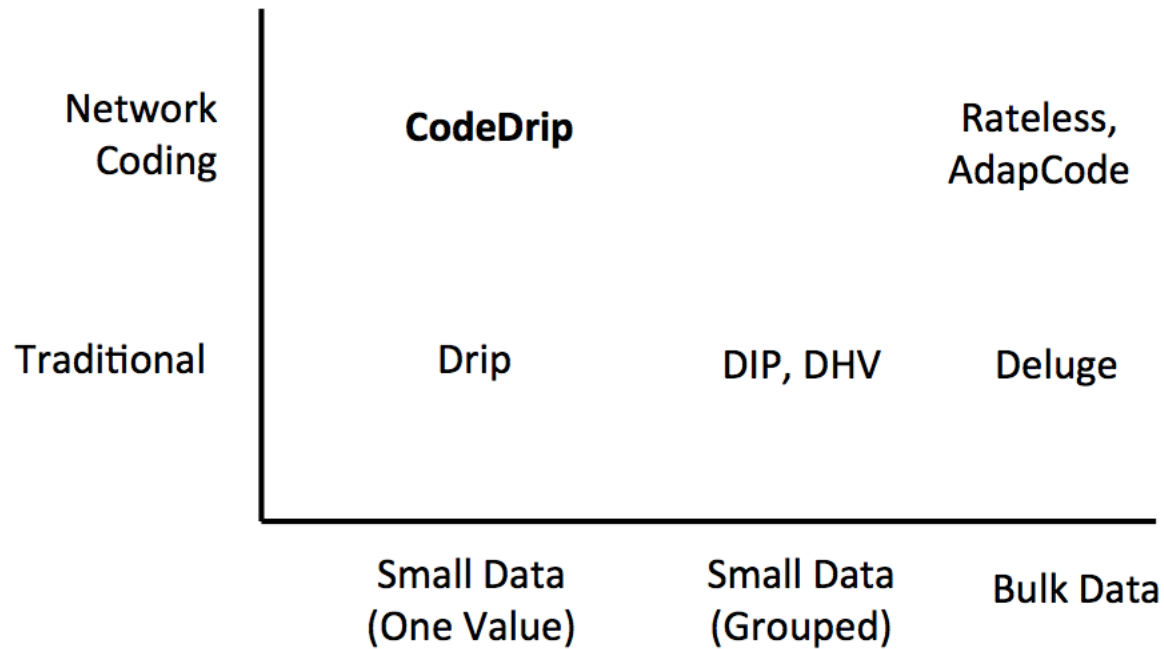Tables

Sub-sections

Competition table

	Small Data (One Value)	Small Data (Grouped)	Bulk Data
Network Coding	**CodeDrip**		Rateless, AdapCode
Traditional	Drip	DIP, DHV	Deluge

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

AFFORDABLE

CouchSurfing

craigslist

BedandBreakfast.com

AirBed&Breakfast

Hostels.com
Every Hostel, Everywhere!

OFFLINE TRANSACTION

ONLINE TRANSACTION

Rent Smart!
rentobi.com
furnished, unfurnished &vacation rentals

VRBO
Vacation Rentals
by owner

hotels.com

EXPENSIVE

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

wrt Review Article

Related work is not literature
review or review paper

Why?

Related Work Regrets

Ideally

- Situate the work in the context of a larger community of scholarship. What's new about this work? What inspired it?
- Provide credit and attribution for methods and ideas that are important to the work, but are not original to the paper.
- Provide concrete support for empirical claims made by the paper.

Reality

- Provide proof that the authors know what they are talking about, because they've clearly read a lot of papers.
- Provide proof that the work "belongs" in your journal or conference, because they cite the bigwigs in your field.
- Provide proof that the authors weren't the first people to make an otherwise unsubstantiated claim.
  Provide lists of people who do related things, so they can be used as reviewers.
- Avoid pissing off the reviewers who do related things, since they might be upset if they weren't cited.

https://mcorrell.medium.com/a-semi-ordered-list-of-things-that-annoy-me-in-research-papers-16d46ee87104

Signs of poor related work

Laundry list of summaries

No explicit relation to the proposed work

Lack of organization

Putting one's work in the context of the field

Other symptoms

    Old papers

    Papers from limited number of sources

The Body of the paper

Depending on the area of work may describe the proposed algorithm, proofs, systems, implementations

Evaluation

Description of experiments and metrics

Results of experiments

Implications of those results

More applicable to the applied areas of computer science.

Conclusions

Not the same as abstract

Short summary of what you did in the project and the implications of the results

Can include lessons learnt and future directions

How to find the ten most important papers in your research area?

HW3

Pick ten papers related to your research

Summarize each paper in 2-3 sentences
   Why is it important?
      Contributions? Strengths? Weaknesses?

Improve related work organization for one of the papers.