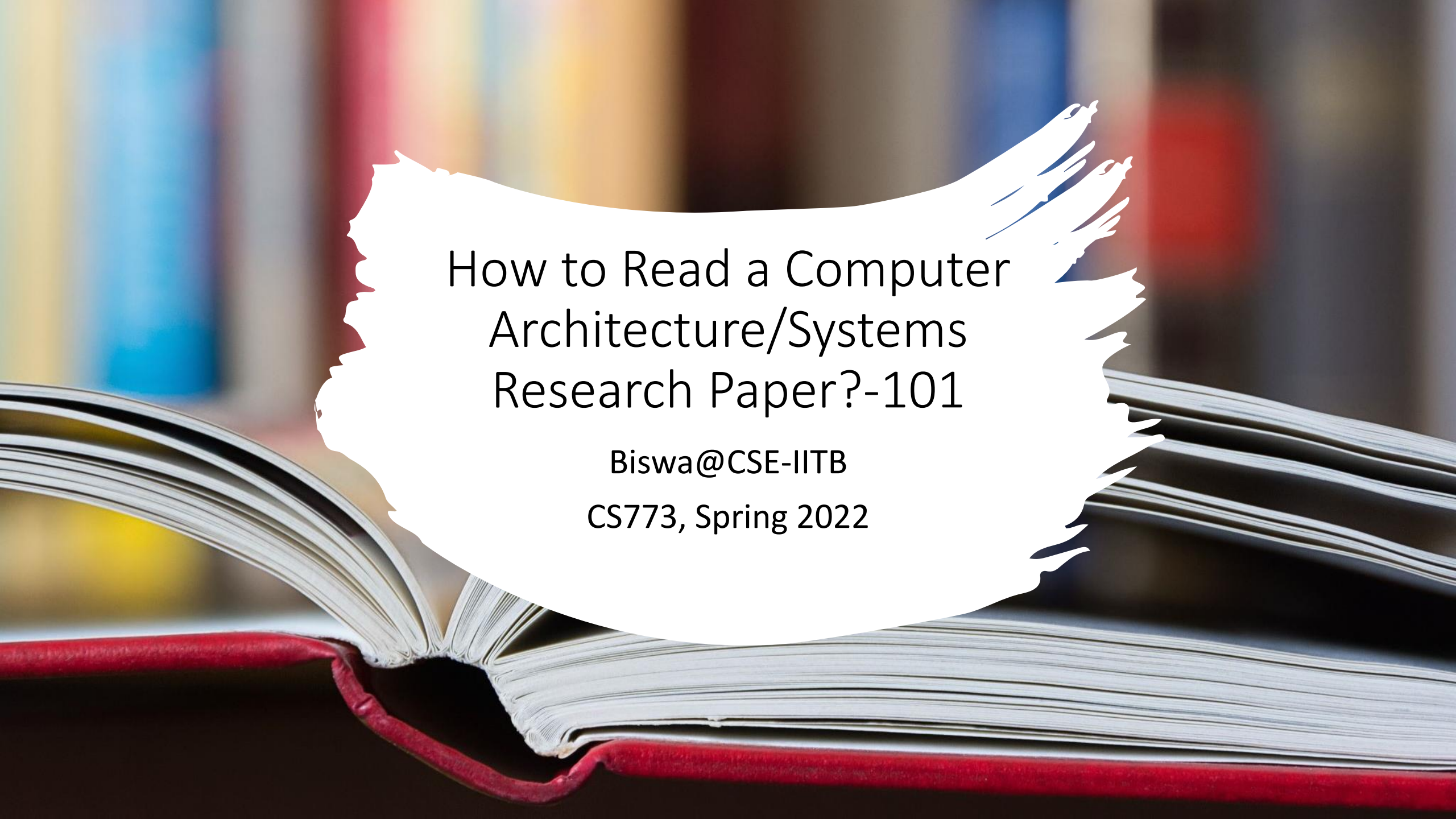


How to Read a Computer Architecture/Systems Research Paper?-101

Biswa@CSE-IITB

CS773, Spring 2022

Paper?

Research Paper

Who Writes it?

Researchers from academia and research labs

Academia:

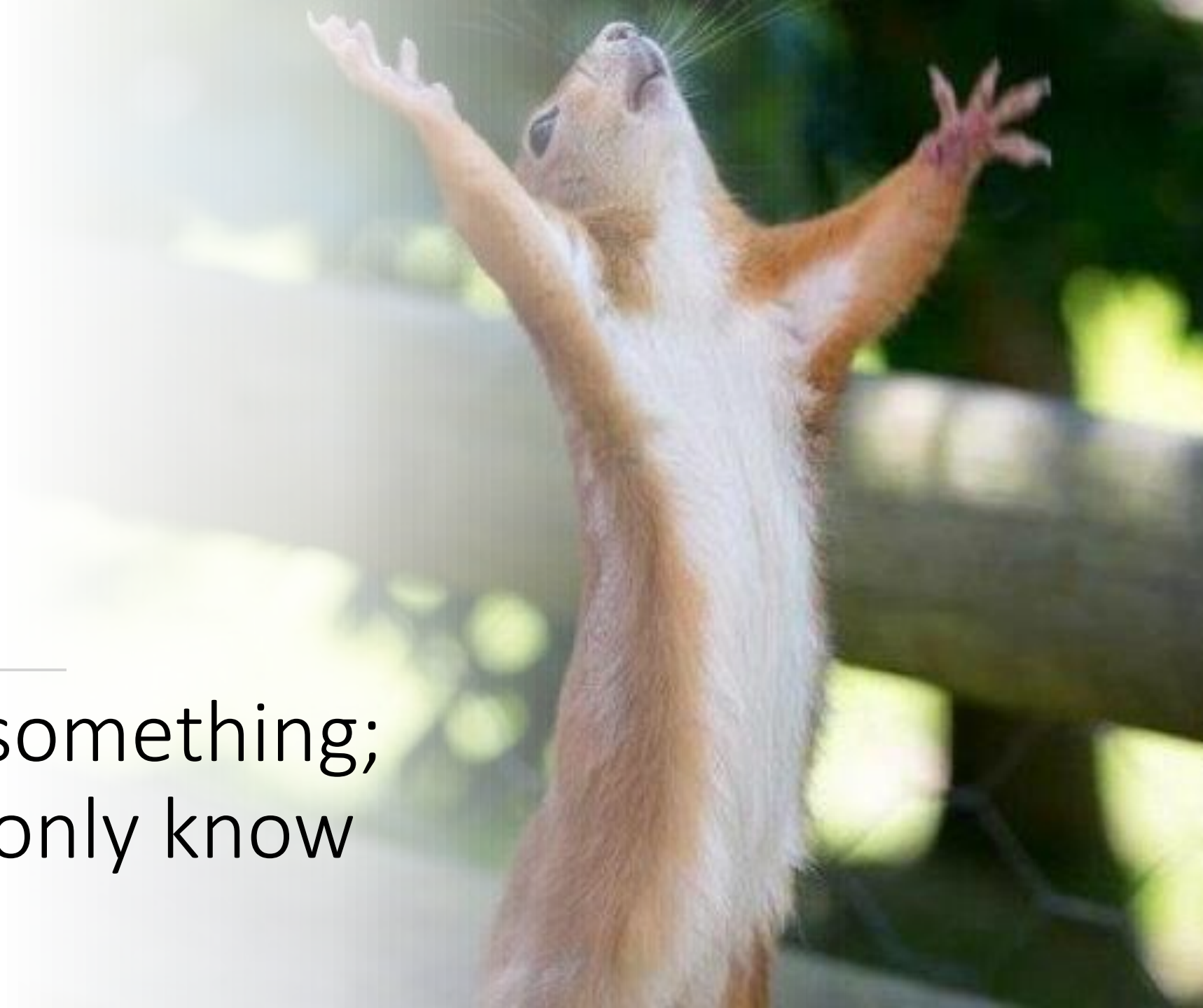
Institutes like IITB

Labs:

Like Microsoft/Google Research

Why they write papers?

To communicate



Communicate something; New that they only know

Show me a Research Paper

How does it look like?

2020 ACM/IEEE 47th Annual International Symposium on Computer Architecture (ISCA)

Bouquet of Instruction Pointers: Instruction Pointer Classifier-based Spatial Hardware Prefetching

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***Abstract*—Hardware prefetching is one of the common off-chip DRAM latency hiding techniques. Though hardware prefetchers are ubiquitous in the commercial machines and prefetching techniques are well studied in the computer architecture community, the "memory wall" problem still exists after decades of micro-architecture research and is considered to be an essential problem to solve. In this paper, we make a case for breaking the memory wall through data prefetching at the L1 cache.**

We propose a bouquet of hardware prefetchers that can handle

prefetchers demand less storage (closer to tens of KBs, except spatial memory streaming (SMS) [47] and Bingo [11]) as compared to the temporal ones (closer to hundreds of KBs). In the 3rd Data Prefetching Championship (DPC-3) [3], variations of these proposals were proposed[1].

It is well understood that the prefetchers at L1 and L2 would need to be different as the access patterns at the L2 are different from those at the L1 (filtered by the L1). The primary reason

Lookahead Prefetching with Signature Path

Jinchun Kim, Paul V. Gratz and A. L. Narasimha Reddy
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***Abstract*—Existing data prefetchers speculate on spatial and temporal locality by tracking past memory accesses. Relying on the past memory accesses restricts the scope of prefetching and potentially further performance improvement. In this paper, we propose a lookahead prefetching algorithm called Signature Path Prefetching (SPP) that accurately predicts the next memory access pattern and exploits this future access to initiate lookahead prefetching. Unlike prior lookahead algorithms, SPP is purely based on the memory access stream and does not require additional support from branch history, PC, or metadata to lookahead future memory access. Within a 32KB storage limit, we evaluate SPP under different memory constrained scenarios and find SPP outperforms the previous competition winner AMPM prefetcher by 4% performance improvement.**

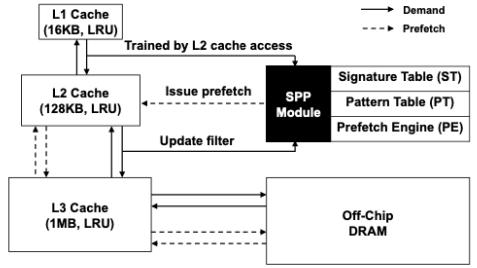


Figure 1: Overall SPP architecture


Tell me more

You Should Read the “Right” papers

Papers appeared in top/good conferences/journals

Please refer
https://www.cse.iitb.ac.in/~biswa/forums.html for a list

An example please

ISCA: Top conference in Computer Architecture

https://iscaconf.org/isca2022/

Why Top? Ideas that resulted into products, ideas with huge impact. Not all ☺

How do these papers appear/get accepted?

Reviewed (double blind) by experts from academia and labs: https://isca2022.hotcrp.com/users/pc

One in five or six papers get accepted at ISCA

Let’s Read a Paper

Oh man! It is 10 to 12 page long ☹

Is there a simple way?

There is a way

Oh Yes!

Typical Flow

Abstract
Introduction
Background and/or Related Work
Motivation
Idea
Results
Conclusions

Paper Reading and Cricket Match (Three Steps)

Adapted from the three-pass approach proposed by Keshav (http://ccr.sigcomm.org/online/files/p83-keshavA.pdf)

Step 1: T20 cricket (five to 10 minutes)

Just read

TITLE: ONE LINE

ABSTRACT: ONE PARAGRAPH

INTRODUCTION: FIVE PARAGRAPHS OR SO

CONCLUSION: ONE PARAGRAPH

PAUSE: Time out in T20

Just read

TITLE: ONE LINE

ABSTRACT: ONE PARAGRAPH

INTRODUCTION: FIVE PARAGRAPHS OR SO

READ THE HEADINGS OF OTHER SECTIONS

CONCLUSION: ONE PARAGRAPH

Decide

Whether you want to read the paper or not

Step 2: 50-overs cricket (50 minutes)

Just read

FIGURES

PLOTS

IDEA

RESULTS


Decide
Whether you want to read further or not

Step 3: Test Cricket (Three hours)

It means you are interested in this paper?


YES


Here we go!
Ask questions on every assumptions, statements, results, plots, figures.

More questions (How to Review Critically -101)

- Why?
- how?
- Why not?
- What if? Any hidden assumptions, any corner cases
- Ah-ha moment, wow moment, oho moment, oh no! moment
- Connect the dots: Connect the outcome of T20 with the test match

Abstract -> Intro -> Insights -> Idea -> Results -> Conclusions

The Outcome of this Reading Exercise (highlights of a cricket match)

What is the problem?

Why a problem?

What is the solution?

Why a good solution?

Key technical insights, observations

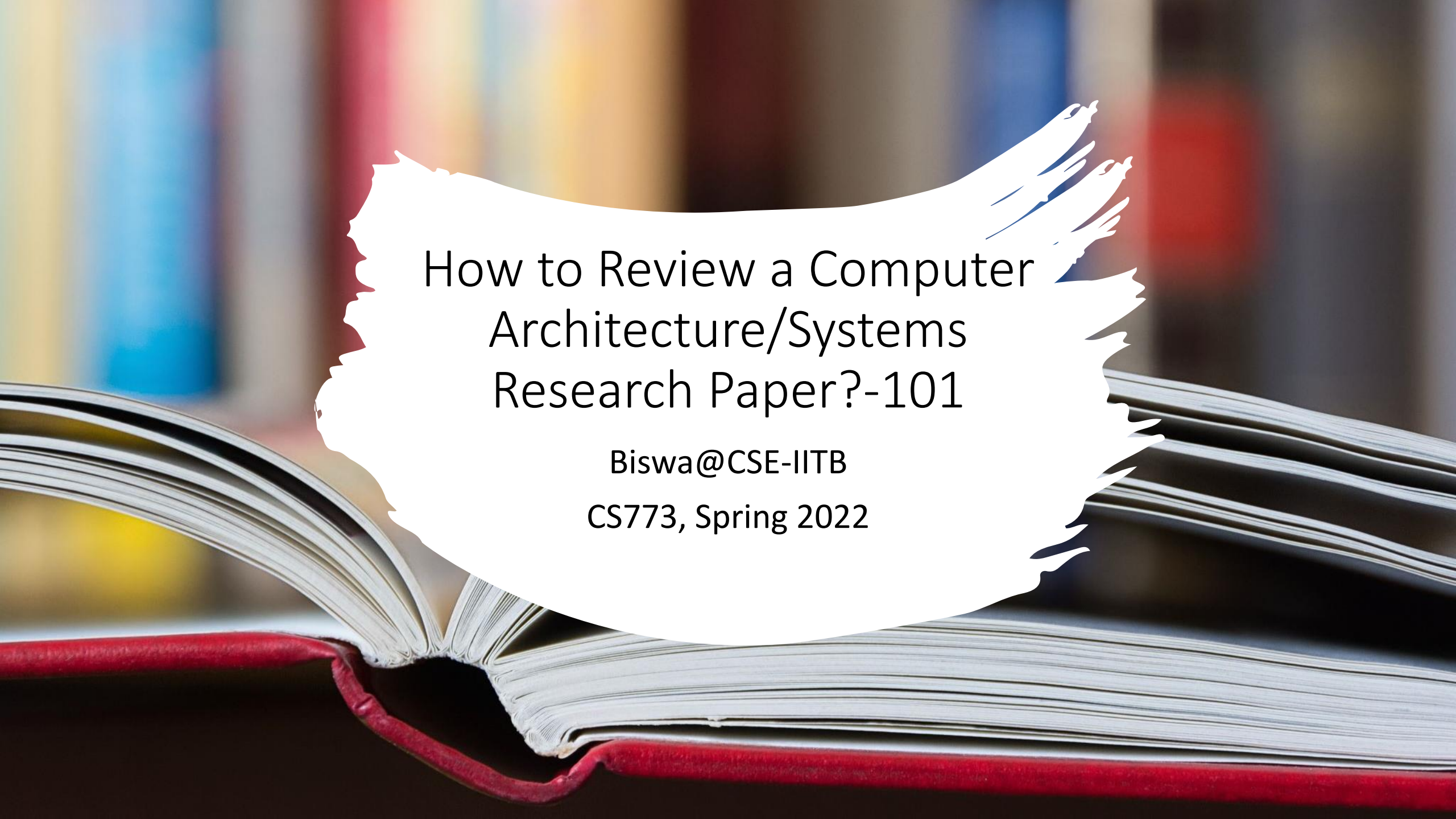
Strengths, Weaknesses

A good set of questions

Time for the mock

Thanks

What Next?
How to review a paper?



How to Review a Computer Architecture/Systems Research Paper?-101

Biswa@CSE-IITB

CS773, Spring 2022

Why Review?

- To understand
- To appreciate
- To find out new ideas/insights
- A feedback mechanism for the authors to improve the idea/paper
- An exercise that facilitates critical thinking

Step 1: Summarize

This paper proposes XYZ that …..

Do not copy the abstract of the paper ☺

Provide a neutral (unbiased) summary.

Step 2: The Contributions

You will find it in Introduction Section

What is the novelty factor?

Technical flaws (if any)

Step 2: The Contributions contd.

Gap between Contributions and Abstract/Conclusions

The cool/wow factor

Technical flaws (if any)

Step 3: The Strengths

New idea?

Awesome results?

Awesome insights?

Does the paper solve the problem well? Is it an incremental idea?

Step 3: The Weaknesses

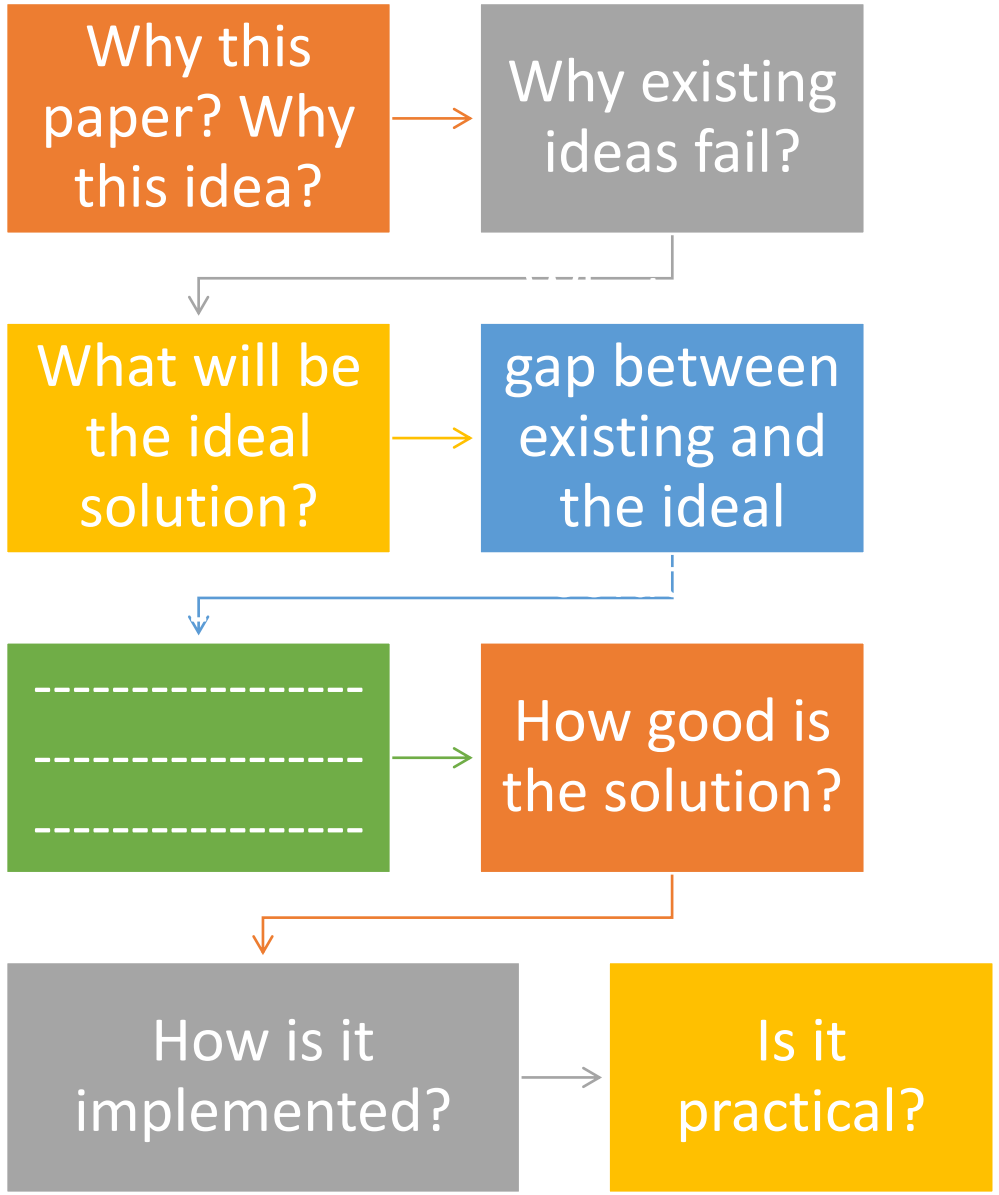
Corner cases?

Can something be improved?

Do you have a better solution?

Weakness does not mean the paper is bad.

Process of What/Whys before Hows?



Step 0: Have a notebook

Mark/note as you read

Comeback after you finish reviewing

See if everything is clear?

Few More Points

Do read the relevant literature if you are unaware of state-of-the-art

Make sure the tone of your review is professional.

However, be critical and more importantly provide constructive feedback.

Review as if others know you are the reviewer (even if no one will know)

Few More Points

- Avoid Vagueness: “it is not good”; “it is not bad”. Defend why?
- Typos and grammar issues should be marked as minor comments and not major
- Keep your eyes open. Well written papers may push you in the zone “owe”
- Enjoy/learn through the process


Time for the Mock

Thanks

What Next?
Start reading and reviewing papers