

# Shivanshu Singh

FINAL YEAR UNDERGRADUATE

Indian Institute of Technology Kanpur

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## Education

### Indian Institute of Technology Kanpur

BACHELOR OF TECHNOLOGY, MAJOR IN MECHANICAL ENGINEERING

- Cumulative Performance Index / CGPA: 8.1/10

Kanpur, India

2014-2018 (Expected)

## Work Experience

### Auto Scaling of Microservices running on Docker Containers

SOFTWARE INTERN, AUTODESK (RECEIVED PRE-PLACEMENT OFFER)

Pune, India

May, 2017 - July, 2017

- Worked on adding the auto-scaling functionality for containers of DC/OS cluster running microservices.
- Built an abstract and modular design with two components, one responsible for fetching and arranging metrics and, other for decision making and scaling.
- Used separate AWS lambda functions for components and AWS SNS service for communication between them.
- Maintained designed state variables of micro-services in Redis database and used AWS CloudWatch for periodic invocation of first component.
- Employed a machine learning technique (Stochastic Gradient Descent), in the second component, to make the calculated guess of amount of scaling (up/down) for each micro-service.

## Projects

### Secure Memory Deduplication and Covert Channel Construction in Linux Kernel

COURSE PROJECT, PROF. DEBADATTA MISHRA

IIT Kanpur

Sep. 2017 - Nov. 2017

- Studied the source code of KSM, a linux kernel(v4.14.4) thread responsible for implementing memory deduplication in linux operating systems.
- Constructed a covert channel for communication between two processes running on same physical machine, separated by VMs.
- Exploited the write-time differences between merged and unmerged pages, caused by COW(copy-on-write) on merged pages, for covert channel construction.
- Designed and developed a synchronized protocol for reliable communication between processes using two mutually known pages content.
- Simulated the information disclosure attack, caused by merging, to detect the content of javascript object typed array in web browser.
- Devised and developed two mitigation techniques, *stochastic false merging* and *stochastic false unmerging*, to introduce significant amount of noise in write time, thus making the covert channel unreliable.

### Large Margin Multi-Modal RGBD Object Recognition

COURSE PROJECT, PROF. VINAY NAMBOODIRI

IIT Kanpur

Sep. 2017 - Nov. 2017

- Worked on improving the semantic information in feature vector representation and consequently classification accuracy of images by leveraging the additional depth channel along with color channels based on this paper.
- Developed a generic convolutional neural network (CNN) that takes two modals as input, processes them separately, correlate them using two correlation matrices and output their linear combination.
- Used a cost/loss function consisting of weighted loss in individual modal CNNs and designed loss incurred while calculating the correlational matrices.
- Employed an alternating approach for optimizing the weights assigned to individual modal in loss function and the correlational matrices.
- Demonstrated successfully the increased classification accuracy when compared to accuracies obtained by using only one modality or several modality but not correlating them.

### Securing Zoobar Server

COURSE PROJECT, PROF. SANDEEP SHUKLA

IIT Kanpur

Jan. 2017 - Apr. 2017

- Simulated various exploitations in a web application called Zoobar, written in C and serving CGI scripts.
- Employed control hijacking techniques like buffer overflow, integer overflow and format string attacks to exploit the vulnerabilities.
- Performed various browser-based attacks like SQL injection, XSS, CSRF on Zoobar web application.
- Fixed security bugs in web server, implemented privilege separation and server-side sand-boxing.
- Demonstrated the limitations of various mitigation techniques like stack canaries, address space layout randomization (ASLR) etc.

## Research Interests

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Broadly Interested in Computer Systems, Cyber-Security and Networking

## Hackathons

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### AMR (Advanced Motion Recognition) System

**WINNER**, 24-HOURS HACKATHON, MICROSOFT'S CODE.FUN.DO

Apr. 2017

- Designed and developed an android app to make the android device a 3D controller to control a uploaded CAD model.
- Used three.js to load and render the model on the browser exposing the APIs to control its orientation and location on the display.
- Established a real time and reliable communication between the android device and the web browser using websockets.

### HashTag

**WINNER**, 24-HOURS HACKATHON, GOOGLE DEVELOPER GROUP

Nov. 2016

- Implemented a file management system on the android device using tags that has superior accessibility capabilities as opposed to conventional file management system.
- Used linked list semantic to manage the mapping between files/folders and tags, and stored them into the SQLite database.

## Mini Projects

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- Implemented various locking mechanisms like spin lock, semaphores, sequential lock, RCU etc. in linux kernel and compared their efficiency empirically.
- Built chat room for processes, when in kernel mode, using a char device and employing the monolithic nature of linux kernel.
- Studied and presented various proof methods like coinduction, fusion etc. for corecursive programs of functional languages. ppt.
- Conceptualised and designed a responsive website for Cultural Council, IIT Kanpur using CodeIgniter MVC framework, jQuery etc.

## Technical Skills

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**Programming** C, Java, Python, Haskell, bash scripting

**Software and utilities** Linux shell utilities, Docker, Vim, Emacs,  $\text{\LaTeX}$ , PyTorch, ROS

**Operating Systems** Arch Linux (with i3wm and xmonad), Debian Linux (Ubuntu, Kali)

## Relevant Courses

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Computer Systems Security (A)	Computer Organization*	Introduction to Programming (A)
Linux Kernel Programming (A)	Principles of Programming Languages (A)	Modern Cryptography*

A: Top Grade, \* ongoing courses

## Miscellaneous

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- Write blog about linux, books and programming in general at [r4ndombits.me](http://r4ndombits.me).
- Volunteered in CSAW (Cyber Security Awareness Weekend) organised by NYU and IIT Kanpur.