WHAT'S TRENDING WITH UNIVERSITY SOFTWARE ENGINEERING COURSES?

A TALK ON

INSIGHTS FROM A PRELIMINARY ANALYSIS

BY

PARAMVIR SINGH
ASSISTANT PROFESSOR
DEPARTMENT OF CSE
NIT JALANDHAR
OVERVIEW

BUDDING COURSES

INSIGHT SUMMARY

RATIONALE

DATA INSIGHTS

CONSTRAINTS

KEY FINDINGS

MANUAL WEB CRAWLING

INCLUSION/EXCLUSION CRITERIA

CONCLUSIONS
• According to a survey conducted by Aspiring Minds [1] for employability focused study “As many as 97% of graduating engineers wants jobs either in software or core engineering. But only 3% have suitable skills to be employed in software or product market and only 7% can handle core engineering tasks.”

• Another survey “A Survey of the Relevance of Computer Science and Software Engineering Education” [2] states that there is margin for improvement in software engineering education.
MANUAL WEB CRAWLING

- **TOP QS/NIRF RANKING UNIVERSITY (SOFTWARE ENGINEERING)**
  - Total: 30
- **TOP 30 FOREIGN UNIVERSITIES (COMPUTER SCIENCE)**
  - Total: 15
- **TOP 15 INDIAN UNIVERSITIES (IITs/IISc/NITs)**
  - Total: 389
- **TOTAL SOFTWARE ENGINEERING COURSES**
  - Total: 389
# Selected Universities

## Foreign Universities

<table>
<thead>
<tr>
<th>QS</th>
<th>University</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Massachusetts Institute of Technology</td>
</tr>
<tr>
<td>2</td>
<td>Stanford University</td>
</tr>
<tr>
<td>3</td>
<td>Carnegie Mellon University</td>
</tr>
<tr>
<td>4</td>
<td>University of California</td>
</tr>
<tr>
<td>5</td>
<td>University of Cambridge</td>
</tr>
<tr>
<td>7</td>
<td>University of Oxford</td>
</tr>
<tr>
<td>8</td>
<td>Princeton University</td>
</tr>
<tr>
<td>9</td>
<td>ETH Zurich</td>
</tr>
<tr>
<td>10</td>
<td>National University of Singapore</td>
</tr>
<tr>
<td>10</td>
<td>University of Toronto</td>
</tr>
<tr>
<td>12</td>
<td>Imperial College of London</td>
</tr>
<tr>
<td>14</td>
<td>University of Melbourne</td>
</tr>
<tr>
<td>15</td>
<td>Tsinghua University</td>
</tr>
<tr>
<td>16</td>
<td>University of Washington</td>
</tr>
<tr>
<td>19</td>
<td>Hong Kong University Of Science and Tech.</td>
</tr>
<tr>
<td>20</td>
<td>Nanyang Technological University</td>
</tr>
<tr>
<td>21</td>
<td>Cornell University</td>
</tr>
<tr>
<td>23</td>
<td>The University of British Columbia</td>
</tr>
<tr>
<td>24</td>
<td>École Polytechnique Fédérale De Lausanne</td>
</tr>
<tr>
<td>24</td>
<td>University of Hong Kong</td>
</tr>
<tr>
<td>26</td>
<td>University of Texas</td>
</tr>
<tr>
<td>27</td>
<td>California Institute of Technology</td>
</tr>
<tr>
<td>28</td>
<td>Georgia Institute of Technology</td>
</tr>
<tr>
<td>29</td>
<td>University of Columbia</td>
</tr>
<tr>
<td>30</td>
<td>University of Illinois Urbana Champaign</td>
</tr>
<tr>
<td>33</td>
<td>Korea Advanced Institute of Sc. &amp; Tech.</td>
</tr>
<tr>
<td>34</td>
<td>Yale University</td>
</tr>
<tr>
<td>46</td>
<td>École Polytechnique Fédérale De Lausanne</td>
</tr>
</tbody>
</table>

## Indian Universities

<table>
<thead>
<tr>
<th>QS</th>
<th>University</th>
</tr>
</thead>
<tbody>
<tr>
<td>152</td>
<td>Indian Institute of Science, Bangalore</td>
</tr>
<tr>
<td>185</td>
<td>Indian Institute of Technology, Delhi</td>
</tr>
<tr>
<td>219</td>
<td>Indian Institute of Technology, Bombay</td>
</tr>
<tr>
<td>249</td>
<td>Indian Institute of Technology, Madras</td>
</tr>
<tr>
<td>302</td>
<td>Indian Institute of Technology, Kanpur</td>
</tr>
<tr>
<td>313</td>
<td>Indian Institute of Technology, Kharagpur</td>
</tr>
<tr>
<td>399</td>
<td>Indian Institute of Technology, Roorkee</td>
</tr>
<tr>
<td>480+</td>
<td>Indian Institute of Technology, Guwahati</td>
</tr>
<tr>
<td>500+</td>
<td>Indian Institute of Technology (BHU), Varanasi</td>
</tr>
</tbody>
</table>

## NIRF Universities

<table>
<thead>
<tr>
<th>NIRF</th>
<th>University</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Indian Institute of Technology, Hyderabad</td>
</tr>
<tr>
<td>11</td>
<td>National Institute of Technology, Trichy</td>
</tr>
<tr>
<td>12</td>
<td>National Institute of Technology, Rourkela</td>
</tr>
<tr>
<td>15</td>
<td>Indian Institute of Technology, Indore</td>
</tr>
<tr>
<td>22</td>
<td>National Institute of Technology, Surathkal</td>
</tr>
<tr>
<td>34</td>
<td>National Institute of Technology, Warangal</td>
</tr>
</tbody>
</table>
INCLUDED-EXCLUSION CRITERIA

Included Courses
• Software Engineering
• Computer Programming
• Software Application Development
• Embedded System Software

Excluded Courses
• Short Term
• Non-Software Engineering
• Seminar Based
• Special Topics
<table>
<thead>
<tr>
<th><strong>Course</strong></th>
<th><strong>Name</strong></th>
<th><strong>Code</strong></th>
<th><strong>Description</strong></th>
<th><strong>Year</strong></th>
<th><strong>Semester</strong></th>
<th><strong>Duration</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>QS/NIRF RANKING</td>
<td>UNIVERSITY</td>
<td>DEPARTMENT</td>
<td>PROGRAMME NAME</td>
<td>NAME</td>
<td>CODE</td>
<td>DESCRIPTION</td>
</tr>
</tbody>
</table>
DATA OVERVIEW

- **GLOBAL SE COURSES**: 19.11% (389 out of 2035)
- **FOREIGN SE COURSES**: 20.94% (333 out of 1590)
- **INDIAN SE COURSES**: 12.58% (56 out of 445)
DATA INSIGHTS INDEX

• Traditional Software Engineering Courses
• Programming Courses
• SDLC Phase Based Courses
• Practice Related Courses
• Project Based Courses
• People Based Courses
• Startup & Entrepreneurship Based Courses
• Insights Summary
DATA INSIGHTS

TRADITIONAL SOFTWARE ENGINEERING COURSES

26.42% FOREIGN COURSES
88 OUT OF 333

33.92% INDIAN COURSES
19 OUT OF 56

EXAMPLE COURSES:
• Introduction to Software Engineering
• Software Testing and Verification
DATA INSIGHTS

PROGRAMMING COURSES

30.63% FOREIGN COURSES
41.07% INDIAN COURSES

102 OUT OF 333
23 OUT OF 56

EXAMPLE COURSES:
• Object Oriented programming
• Java for programmers
In Foreign Universities, mostly Java, C++ and Python are taught.

In Indian Universities, C, Java and C++ are taught.
DATA INSIGHTS

SDLC PHASE BASED COURSES

11.11% FOREIGN COURSES ARE PHASE BASED
37 OUT OF 333

7.14% INDIAN COURSES ARE PHASE BASED
5 OUT OF 56

EXAMPLE COURSES:
• Software Requirement Analysis and Application
• Verification and Validation of Software
DATA INSIGHTS

FOREIGN COURSES ARE PRACTICE BASED
7.51% 15 OUT OF 333

INDIAN COURSES ARE PRACTICE BASED
7.14% 2 OUT OF 56

EXAMPLE COURSES:
• Software Engineering Practice
• Software & System Product Line Engineering
DATA INSIGHTS

PROJECT BASED COURSES

<table>
<thead>
<tr>
<th></th>
<th>FOREIGN UNIVERSITIES</th>
<th>INDIAN UNIVERSITIES</th>
</tr>
</thead>
</table>

- **2.40%** FOREIGN COURSES (8 OUT OF 333)
- **1.78%** INDIAN COURSES (1 OUT OF 56)

EXAMPLE COURSES:
- Software Systems Project
- Open-Source Software Project Development
DATA INSIGHTS

FOR A TOTAL OF 5 PEOPLE BASED COURSES

1.50% FOREIGN COURSES
0.00% INDIAN COURSES

5 OUT OF 333
0 OUT OF 56

EXAMPLE COURSES:
- Social Information Network Analysis and Engineering
- Software Development For Social Good
DATA INSIGHTS

STARTUP AND ENTREPRENEURSHIP RELATED COURSES

1.80% FOREIGN COURSES

0.00% INDIAN COURSES

6 OUT OF 333

0 OUT OF 56

EXAMPLE COURSES:

• Start-up Systems Design and Engineering
• Software Engineering for Start-up
INSIGHT SUMMARY

TRADITIONAL SE
PROGRAMMING
SDLC PHASE
PRACTICE
PROJECT
PEOPLE
START-UP

FOREIGN UNIVERSITIES
INDIAN UNIVERSITIES
BUDDING COURSES

FUTURISTIC COURSES

• Startup Systems Design And Engineering
• Mobile News App Design
• Intro Enterprise Compute
• Creative Design Of Intelligent Robots
• Automated Software Testing
• Artificial Intelligence Based Software Engineering
• Human-Robot Interaction
• Software Ecosystem
• Programming Musical Applications
• Applications In The Digital Humanities

• Beyond Bits And Atoms: Designing Technological Tools
• Software Foundations Of Security And Privacy
• Software Development For Social Good
• Software Engineering Reflection
• Foundations Of Eiffel-programming
• Datacentre Software Dynamics
• Agile IT With Devops
• The Design Of Interactive Computational Media
• Software Engineering For SaaS And Cloud Computing
• Software Development For Data Scientist
• Programming Abstractions And Social Good
BUDDING COURSES

• Creating Video Games
• iOS Game Design and Development Competition
• Game Theory with Engineering Applications
• Introduction to Game Design and Development
• Computer Game Programming
• Computational Game Theory
• Game Development Project
• Game Programming
• Music, Computing, Design I: Art of Design for Computer Music (MUSIC 256A)

CREATIVE COURSES

• Computer Music Systems and Information Processing
• Introduction to Computer Game Architecture
• Computer game design and programming
• Video Game Design and Programming
• Principles of Computer Game Software
• Programming Musical Applications
• Computer Music: Algorithmic and Heuristic Composition
• Computer Music: Sound Representation and Synthesis
BUDDING COURSES

PRACTICE BASED COURSES

• Software Engineering Reflection
• Case Studies from Practice
• Software Engineering Practicum
• Software Project Experience with Corporate Partners
• Software Projects for Industrial Collaboration
• Software & Systems Product Line Engineering
KEY PRELIMINARY FINDINGS

• Overall percentage of path-breaking software engineering courses is still very low globally.

• Many interesting start-up, creative technologies, social aspects related software engineering courses are coming up.

• Top Indian universities mostly offer conventional software engineering courses and score low on contemporary course facets.

• Foreign universities introduce software engineering courses earlier in comparison to Indian universities.

• Software design phase is targeted by the highest number of software engineering courses.

• Korea Advanced Institute of Science & Technology has maximum no of budding courses such as Automated Software Testing, Artificial Intelligence Based Software Engineering, Bionic Human-Robot Interaction, Software Ecosystem and Creative design of intelligent robots.
STUDY CONSTRAINTS

- Not Included:
  - Short-term Courses
  - Seminars
  - Special Topics

- Preliminary Study with total 45 universities

- Not Contacted course instructors

- Misinterpreted, Missing or Skipped data elements

Course Details not explored
BIBLIOGRAPHY

1. “A Survey of the Relevance of Computer Science and Software Engineering Education” Timothy C. Lethbridge, School of Information Technology and Engineering (SITE)


5. Data Sources - All University Websites
THANK YOU

@ParamvirSingh_
pvsingh.com
singhpv@nitj.ac.in

CONTACT

Support Team
Apexit Dhandav
Rajat Sharma
Amit K. Dogra