

# Teaching Parallel Computing: Architectures, Algorithms, and Applications

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## Course

- **Topic:** Parallel Computing course incorporating parallel architectures, algorithms, and applications.
- **Tested:** Successfully used in class for over 10 years
- **Hands-on:** Cool and inspirational projects are given so that students have fun and be inspired.
- **Effective:** This comprehensive approach is successful based on student and industry feedback

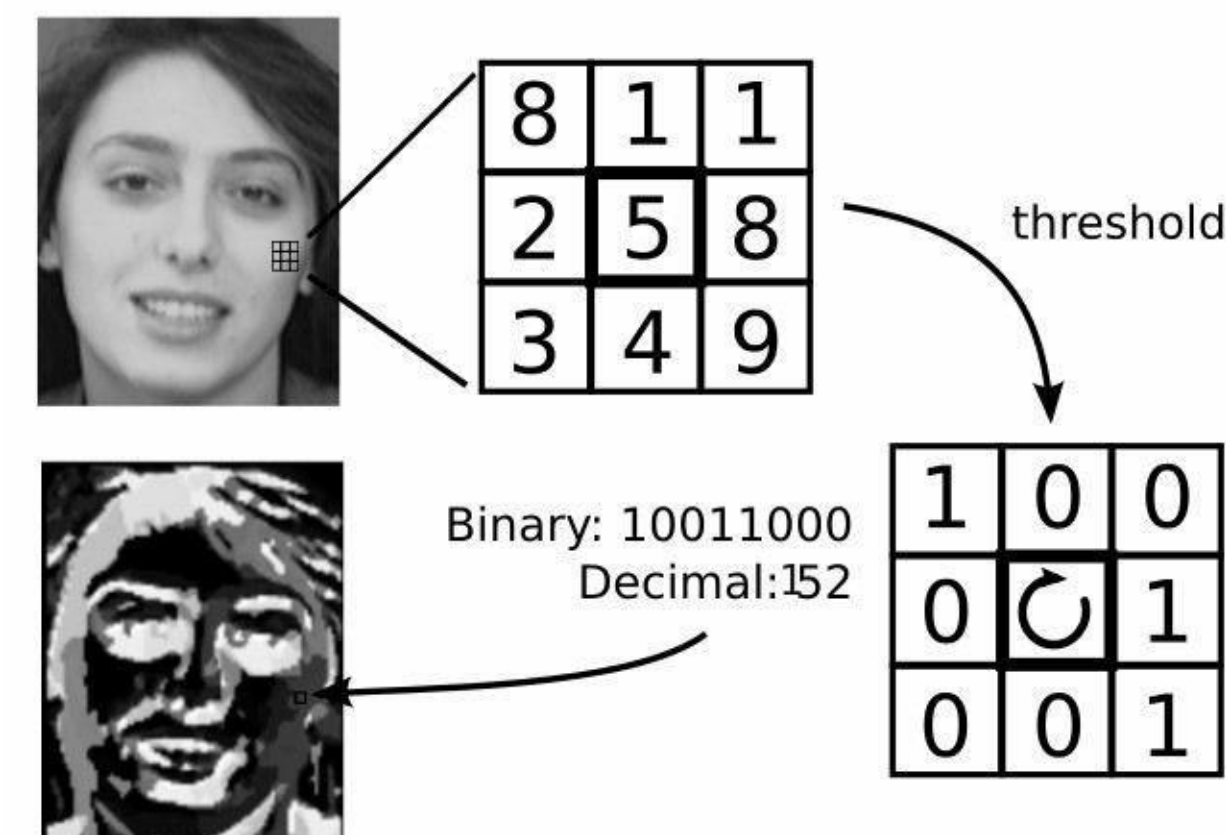
Part of an undergraduate curriculum and offered every year, possibly multiple times.

Students in the class had no previous exposure to parallel programming topics.

## Face Recognition

### Local Binary Patterns

- Convert pixels to numbers based on relationship with neighbors:



- Image stored as histogram of numbers
- Allows comparison to labeled images

### Assignment

Write serial C/C++ version, then profile and parallelize using OpenMP. Used in parallel computing elective

## Course Evaluation

|   | Spring 2012 | Spring 2013 | Spring 2014 | Fall 2015 | Fall 2016 | Fall 2017 | Spring 2019 | Spring 2020 | Fall 2020 | Summer 2020 | Fall 2021 | Fall 2022 |
|---|-------------|-------------|-------------|-----------|-----------|-----------|-------------|-------------|-----------|-------------|-----------|-----------|
| Stimulates interest in the subject  | 4.73        | 4.89        | 4.5         | 4.88      | 4.85      | 4.56      | 5           | 4.89        | 4.64      | 4.91        | 4.75      | 5         |
| Stimulates in-class student participation effectively                                 | 4.73        | 4.89        | 4.69        | 4.75      | 4.7       | 4.56      | 4.91        | 4.89        | 4.82      | 4.85        | 4.81      | 5         |
| Develops students' analytical, creative, critical, and independent thinking abilities | 4.64        | 5           | 4.58        | 4.88      | 4.7       | 4.56      | 4.91        | 4.89        | 4.91      | 4.78        | 4.81      | 5         |
| I learned a lot in this course  | 4.73        | 4.89        | 4.65        | 4.88      | 4.45      | 4.56      | 4.82        | 4.89        | 4.73      | 4.91        | 4.41      | 5         |
| Exams, assignments and projects required analytical, creative, and critical thinking  | 3.82        | 4.67        | 4.35        | 4.75      | 4.8       | 4.56      | 4.64        | 4.89        | 4.55      | 4.88        | 4.33      | 5         |
| Rate the overall teaching   | 4.82        | 5           | 4.5         | 5         | 4.8       | 4.56      | 4.73        | 4.89        | 4.91      | 5           | 4.67      | 5         |

## Syllabus

1. Introduction
2. Parallel Programming Platforms
3. Trends in Microprocessor Architectures
4. Communication Costs in Parallel Machines
5. Interconnection Networks
6. Basic Communication Operations
7. Collective Communication Operations
8. Principles of Parallel Algorithm Design
9. Parallel Algorithm Models
10. Analytical Modeling of Parallel Programs
11. Parallel Programming Concepts
12. Programming Using the Message Passing
13. Programming Shared Address Space Platforms
14. GPU programming
15. Performance Optimizations for Parallel Platforms

For the assignment and more: [http://cs.bilkent.edu.tr/~ozturk/OpenMP\\_assignment.html](http://cs.bilkent.edu.tr/~ozturk/OpenMP_assignment.html)