PERSONALIZED MOOC RECOMMENDATIONS

MOOCREC V2

MOOCs, chosen just for you.

AN OVERVIEW OF MOOCS

Source: https://www.class-central.com/report/moocs-stats-and-trends-2018/

Figure 1: MOOCs Statistics from Class Central

RESEARCH PROBLEM

- MOOCs have different video production styles
- MOOCs have a low completion rate
- Consumers prefer different types of video production styles
- Lack of connection between MOOC recommenders' and consumers' preference for video production styles
- No personalization exists for MOOC recommendations

GENERAL OBJECTIVES

- ✓ Identifying user's learning styles by a more interactive method
- ✓ Implement support for parallel processing to significantly improve performance
- ✓ Improve MOOC recommendations based on information within discussion forums
- ✓ Add support for categorizing newer & more complex video styles

SPECIFIC OBJECTIVES

Hub for MOOCs

- A catalogue of MOOCs from most popular providers
- Forum activity across platforms are analyzed automatically

Personalized MOOCs

- Identifying user's learning styles by a more interactive method
- Use the sentiments of other users

Parallel Image Classification

- Accurately classify a wide range of video production styles
- Efficiently classify using parallel processing

VIDEO PRODUCTION STYLES

- MOOCs are delivered in different styles of video
- Consumers may not prefer some styles of videos
- Some MOOCs contain multiple video styles

LEARNING STYLES AND DIMENSIONS

- People have different styles of learning, according to Felder and Silverman
- A mismatch between learning styles and video styles exists

MOOCREC V1

- A solution proposed by a previous research
- Proposed solution, MOOCRec V2 extends up on MOOCRec V1
- Identifies learner styles using a lengthy questioner
- Covers only a few video production styles
- Inefficient video classification

FEATURE COMPARISON

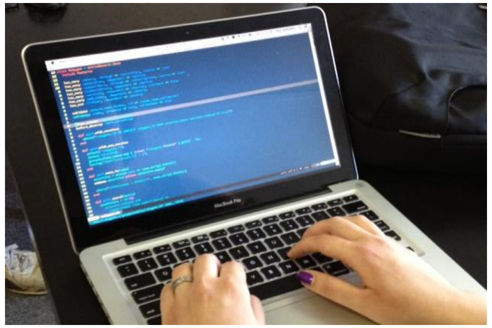
Features	Class Central	My MOOC	MOOCRec	MOOCRec V2 Proposed Solution
Direct learning style identification	✗	✗	✗	✓
Video Production Styles	✗	✗	✓	✓
Complex and mixed video production styles	✗	✗	✗	✓
Identify the spoken language of the presenter	✗	✗	✗	✓
Search filter based on specific keywords / topics	✗	✗	✓	✓
User profile and dashboard	✗	✗	✓	✓
Online discussion forums analysis and extraction of sentiments of forum posts for better MOOC recommendations	✗	✗	✗	✓

COMPLEX VIDEO PRODUCTION STYLE CLASSIFICATION

- Different types of MOOC video production styles

Talking Head

Presentation slides with voiceover



Coding/Demonstration

Conversations

Writing

Animation

COMPLEX VIDEO PRODUCTION STYLE CLASSIFICATION

Figure 2: Multiple Video styles in one video

- Some MOOC videos may contain multiple video production styles.
- Identification of Percentage of each production style in a video.
- Video will be split into frames and using Convolutional Neural Networks(CNN) frames will be classified.
- To increase the speed and accuracy of CNN Sparse and Low-rank decomposition shot segmentation method will be used.

COMPLEX VIDEO PRODUCTION STYLE CLASSIFICATION

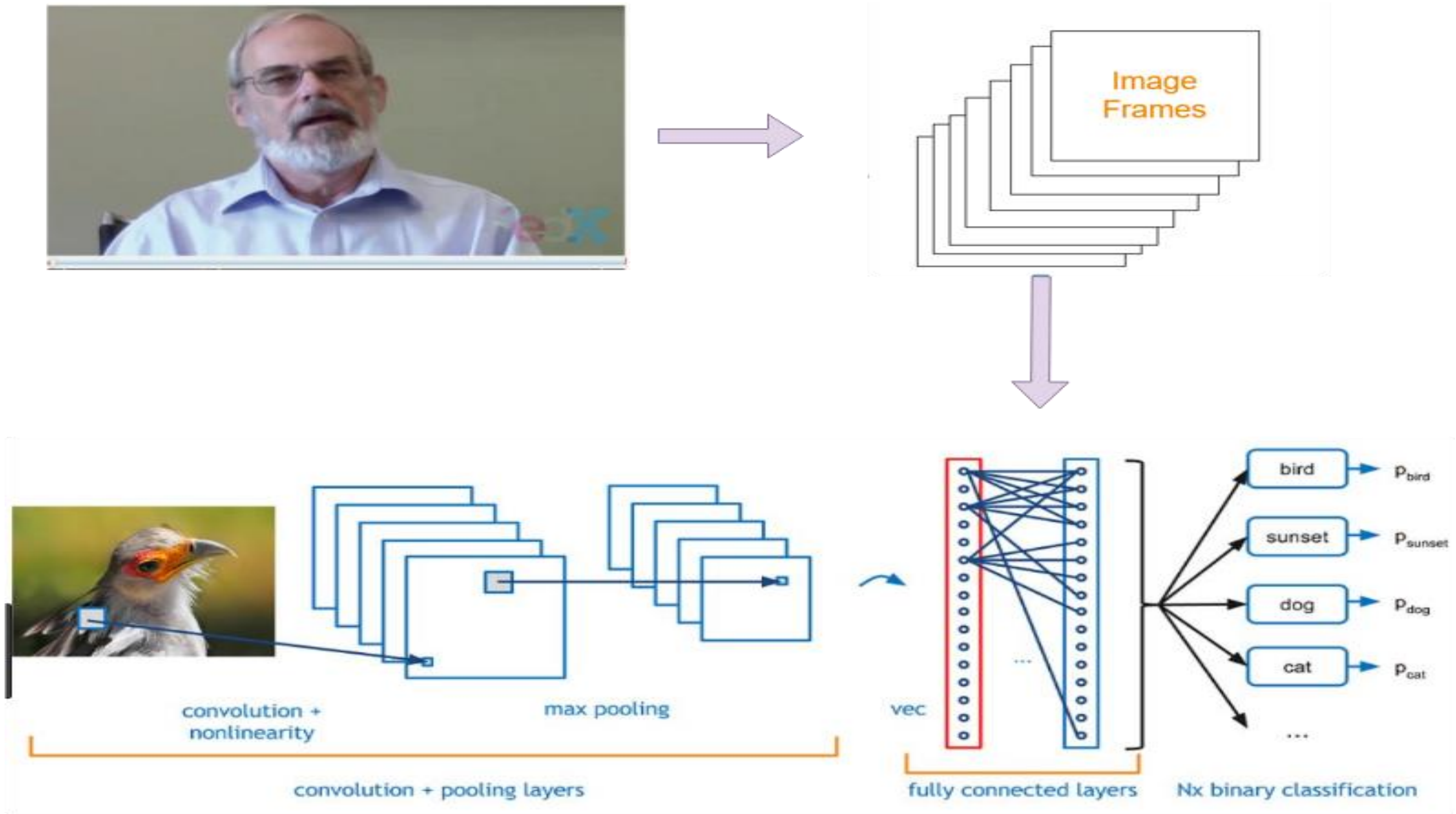


Figure 3 : Video Classification

IDENTIFYING USER'S PREFERRED LEARNING STYLE

- ✓ Identified using an interactive introductory video
- ✓ Intro video contains MOOCs learning material types recognized by MOOCRec V2
- ✓ Learning material types and Felder Silverman Learning Style Model are mapped
- ✓ Mapping is introduced based on literature survey

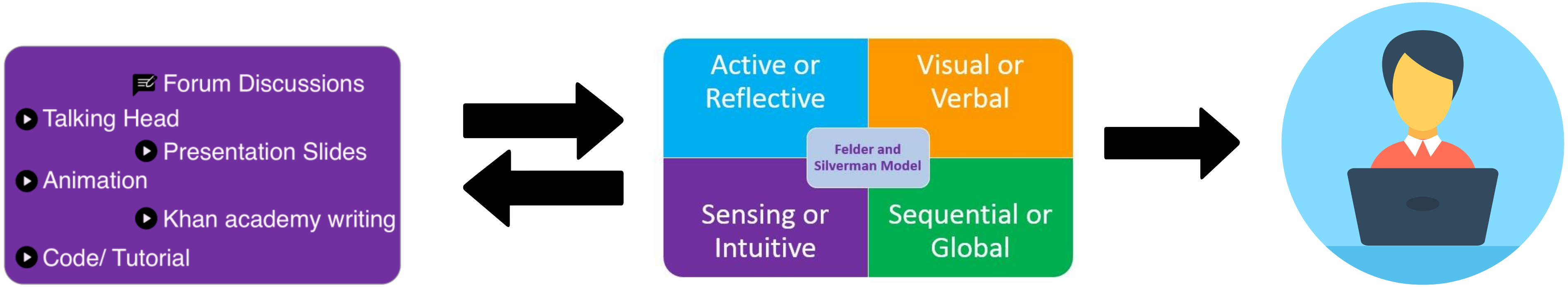


Figure 6: Learning Material Type to FSLSM Mapping

IDENTIFYING USER'S PREFERRED LEARNING STYLE

PROCEDURE

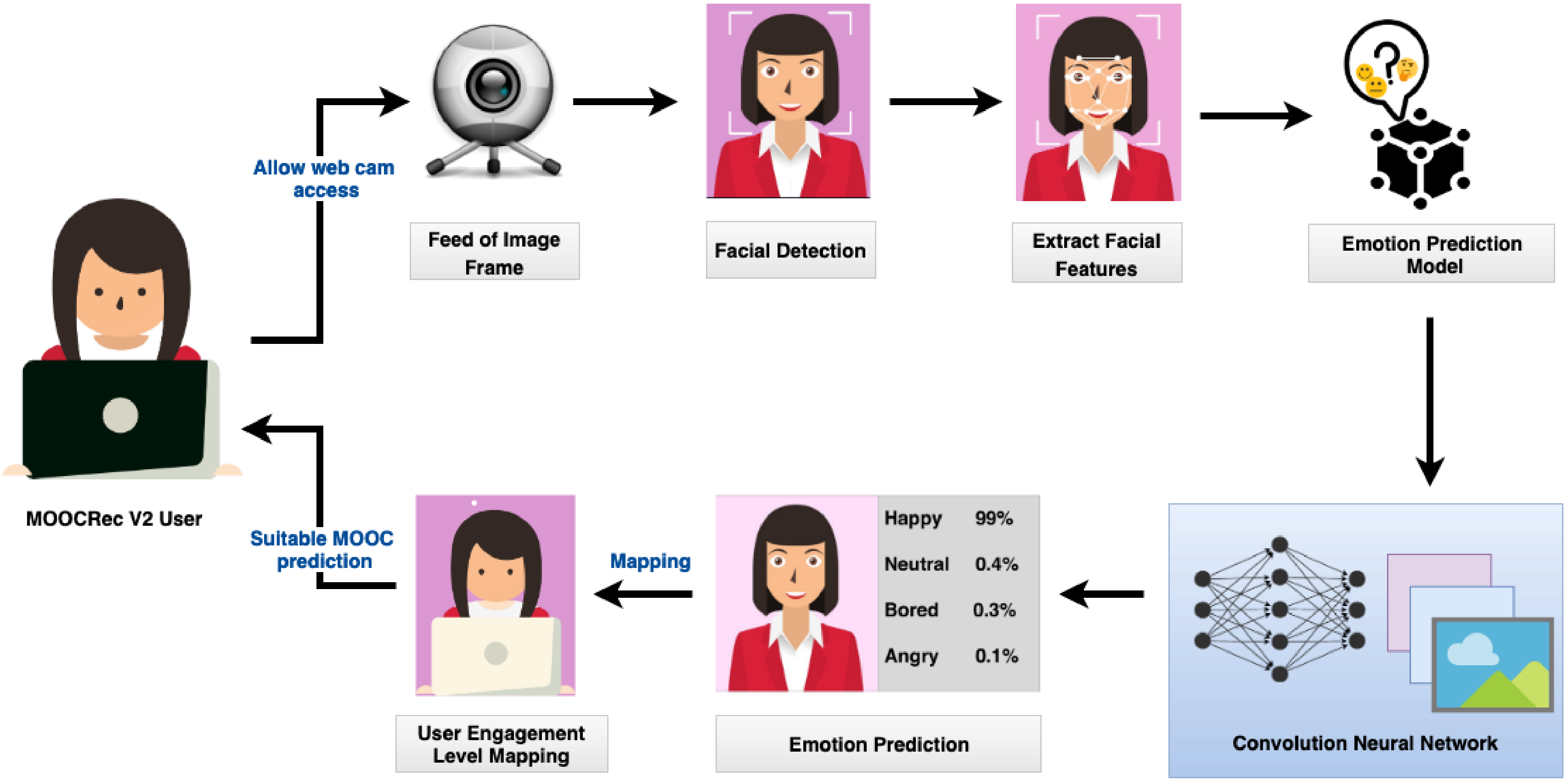


Figure 9 : Procedure of identifying User's Preferred Learning Material

IDENTIFYING USER'S PREFERRED LEARNING STYLE

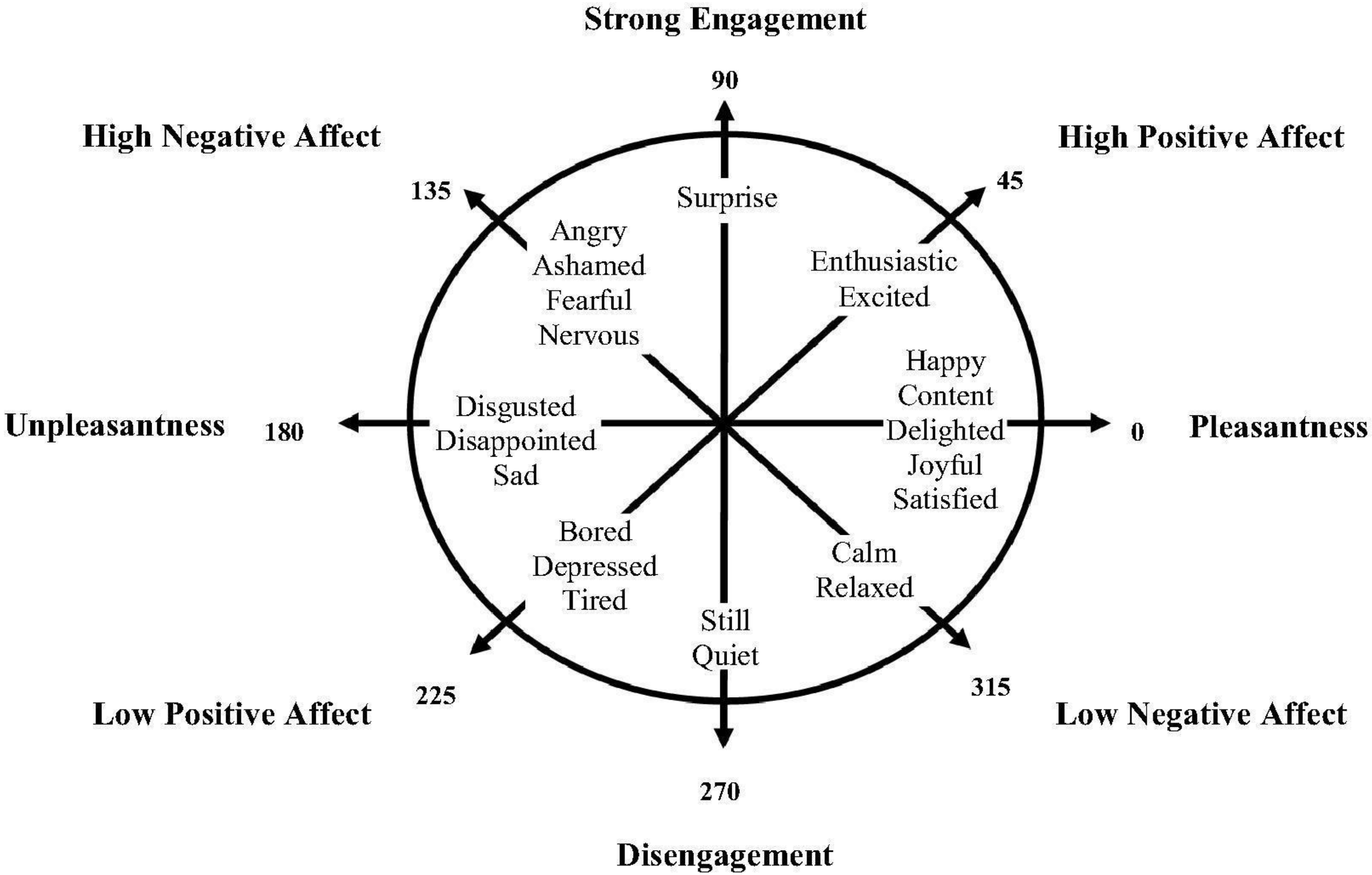


Figure 8 : Academic Emotion and User Engagement Level Mapping

IDENTIFYING USER'S PREFERRED LEARNING STYLE

HOW?

- ☑ By identifying user engagement level based on facial emotions
- ☑ Mapped adapting Russell and Feldman model, Watson and Tellegen Model and literature studies

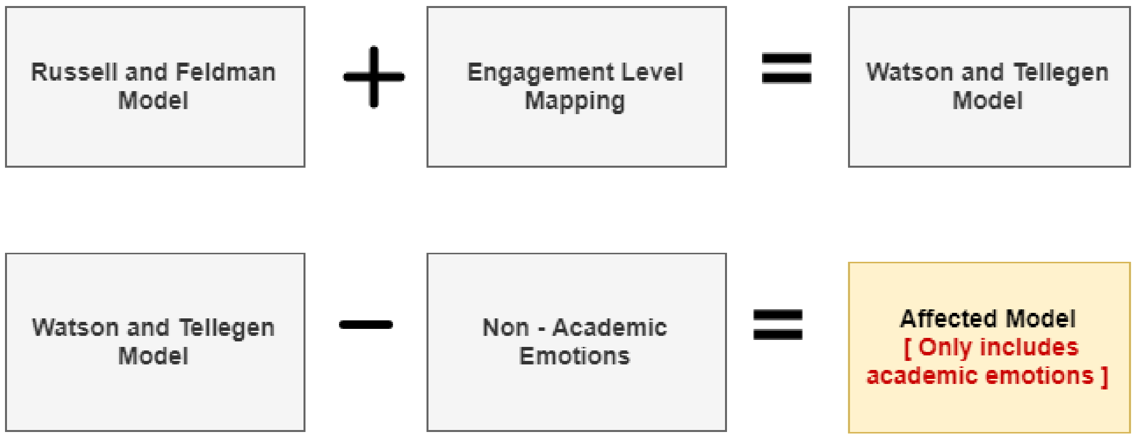


Figure 7 : Procedure of deriving affected model

IDENTIFYING USER’S PREFERRED LEARNING STYLE

SURVEY

Do you like if an online learning platform automatically identifies your learning style or to fill a questionnaire and identify your learning style?

45 responses

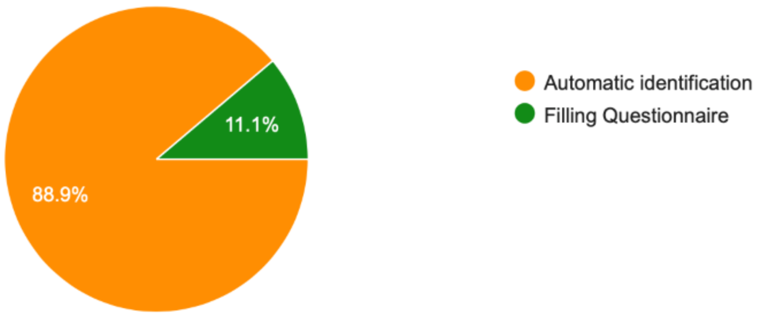


Figure 4 : Survey on Filling a Questionnaire

Do you like allowing the online learning platform to analyze your facial expressions only once by turning on your webcam and watch a video of 5-10 minutes to help you automatically identify your learning style given that your data is not shared with any other party?

40 responses

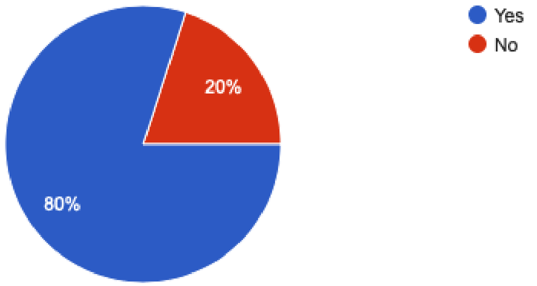


Figure 5: Survey on Users' Willingness to Provide Temporary Web Cam Access

Source: https://docs.google.com/forms/d/e/1FAIpQLSfig75HUEIsAtCSSNVxGxtzBH7j2jHXakWVn9OvOC-8sjaTgQ/viewform

FORUM ANALYSIS
WHY?

1. Users who prefer learning through peer-to-peer interactions need to be recommended MOOCs which have high forum activity

Figure 10: Required recommendation characteristic

2. Currently **ratings & reviews** aren't considered when recommending MOOCs in MOOCRec V1

FORUM ANALYSIS
OVERVIEW

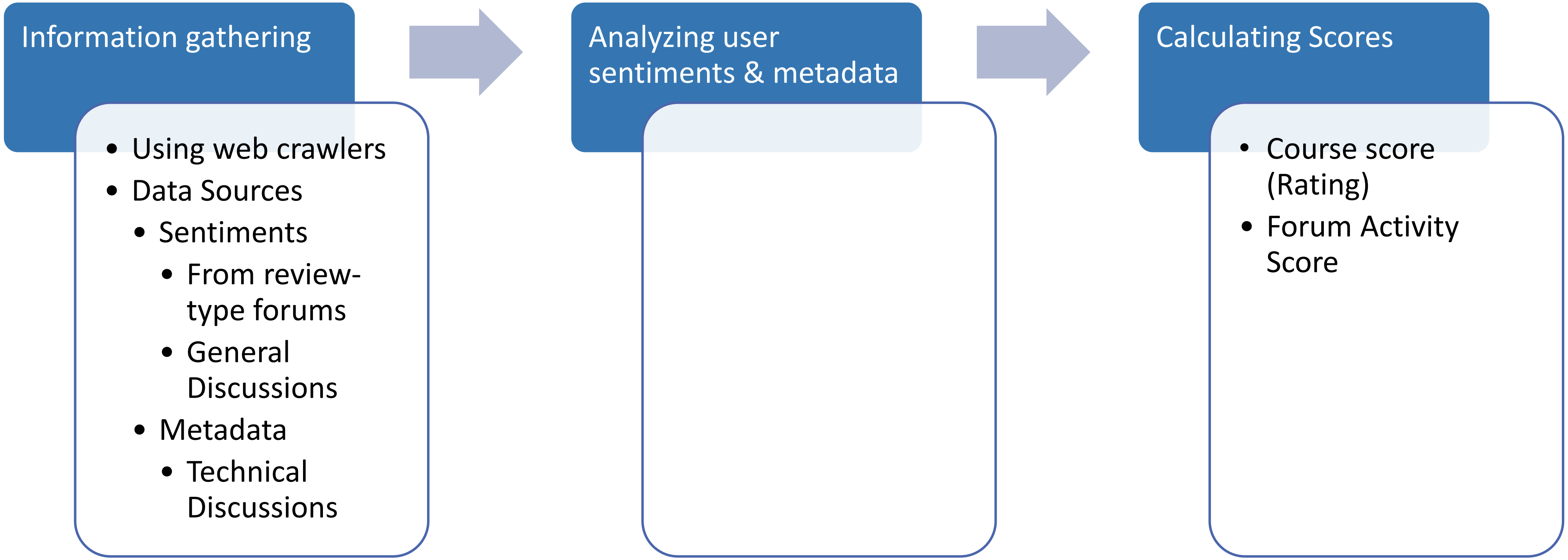


Figure 11 : Forum Analysis Process

FORUM ANALYSIS

GATHERING DATA

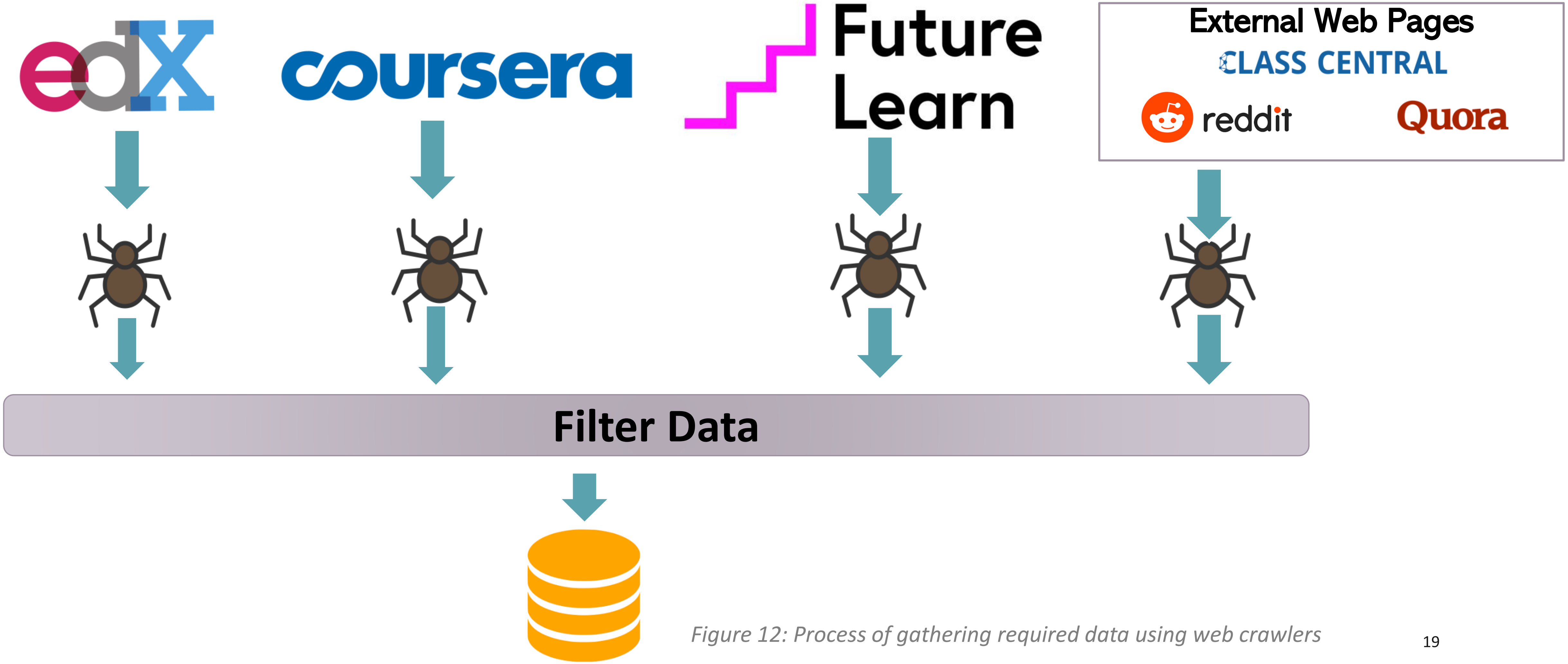


Figure 12: Process of gathering required data using web crawlers

FORUM ANALYSIS
PROCESS

1. About the course
   1. Review-type forums (Sentiment Extraction)
   2. Ratings from several platforms
   3. General Discussions

Course Score

2. Content of the course
   1. Technical Discussions
   2. Q & A
3. About the topic of the course
   1. Technical discussions about the topic (not linked to a course)

Forum Activity Score

FORUM ANALYSIS
EXPECTED RESULT

Course	Course Score (Rating)	Forum Activity Score
Machine Learning – Coursera (Stanford Uni.)	9.2	8.9
Machine Learning – Coursera (Columbia Uni.)	7.8	3.2
Machine Learning - edX	7.6	8.8
Machine Learning – Future Learn	5.4	4.0

PARALLEL VIDEO CLASSIFICATION

- Over 11 400 MOOCs right now
- Assuming every MOOC has one 8-minute video
  - 24 frames per second
  - 480 seconds per MOOC
  - 11 520 frames per MOOC
  - **131 328 000 image frames to Analyze**
- Analyzing using a single-threaded/monolithic architecture can
  - Cause loss of progress if the classifier crashes
  - Underutilize processing power available
  - Hard to scale to meet increasing/decreasing demands

PARALLEL VIDEO CLASSIFICATION

- With parallelized, independent docker containers
  - Workload is distributed
  - Workload is independent
  - No loss of progress by using Message Queues
  - Can scale up or down with ease
- Ability to run two differently trained classifiers/techniques on the same data set

PARALLEL VIDEO CLASSIFICATION
TECHNIQUES

- SIMD
  - Single Instruction Multiple Data-stream
- SISD
  - Single Instruction Single Data-stream
- MIMD
  - Multiple Instructions Multiple Data-stream
- MISD
  - Multiple Instructions Single Data-stream

PARALLEL VIDEO CLASSIFICATION
APPROACH 1

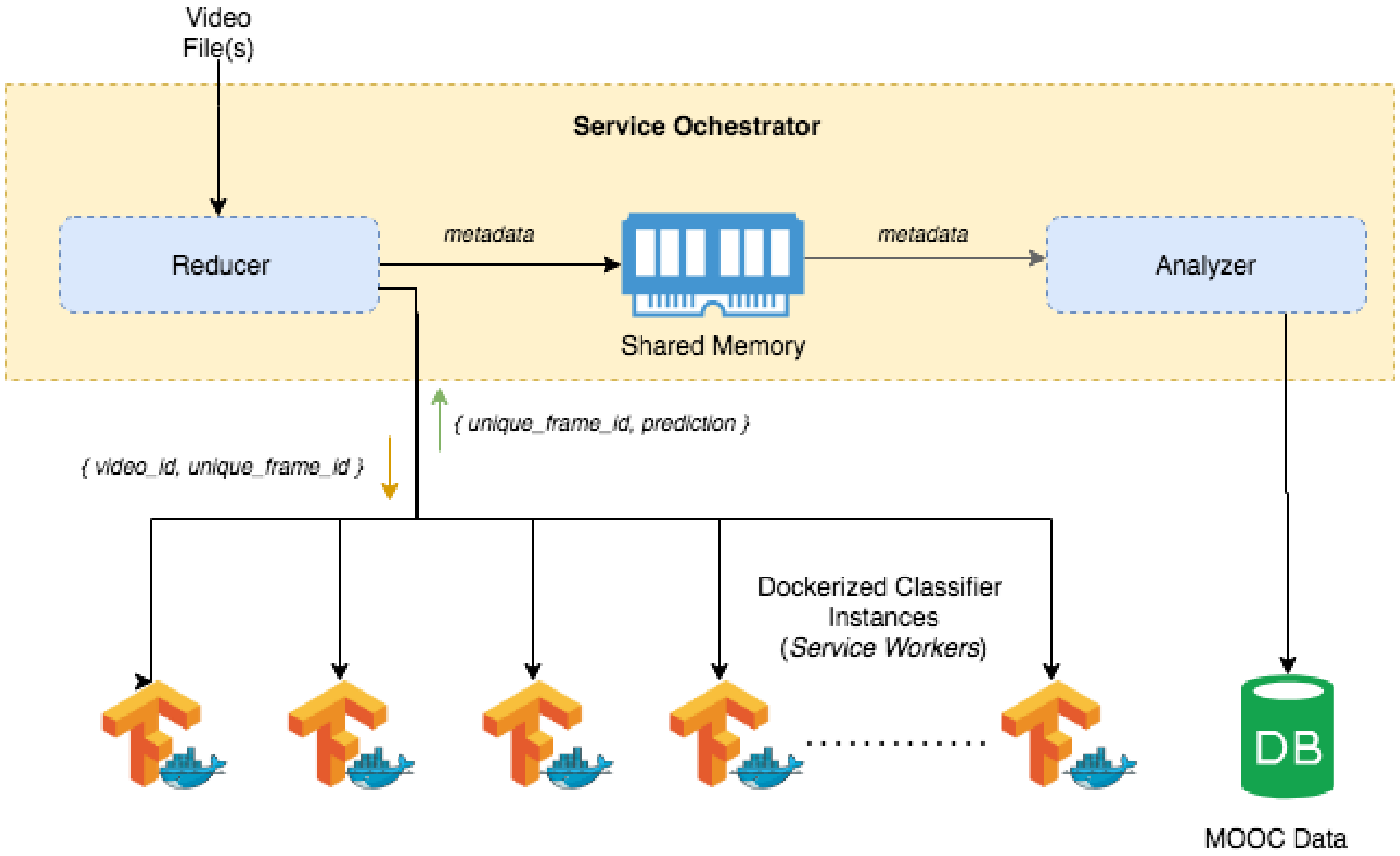
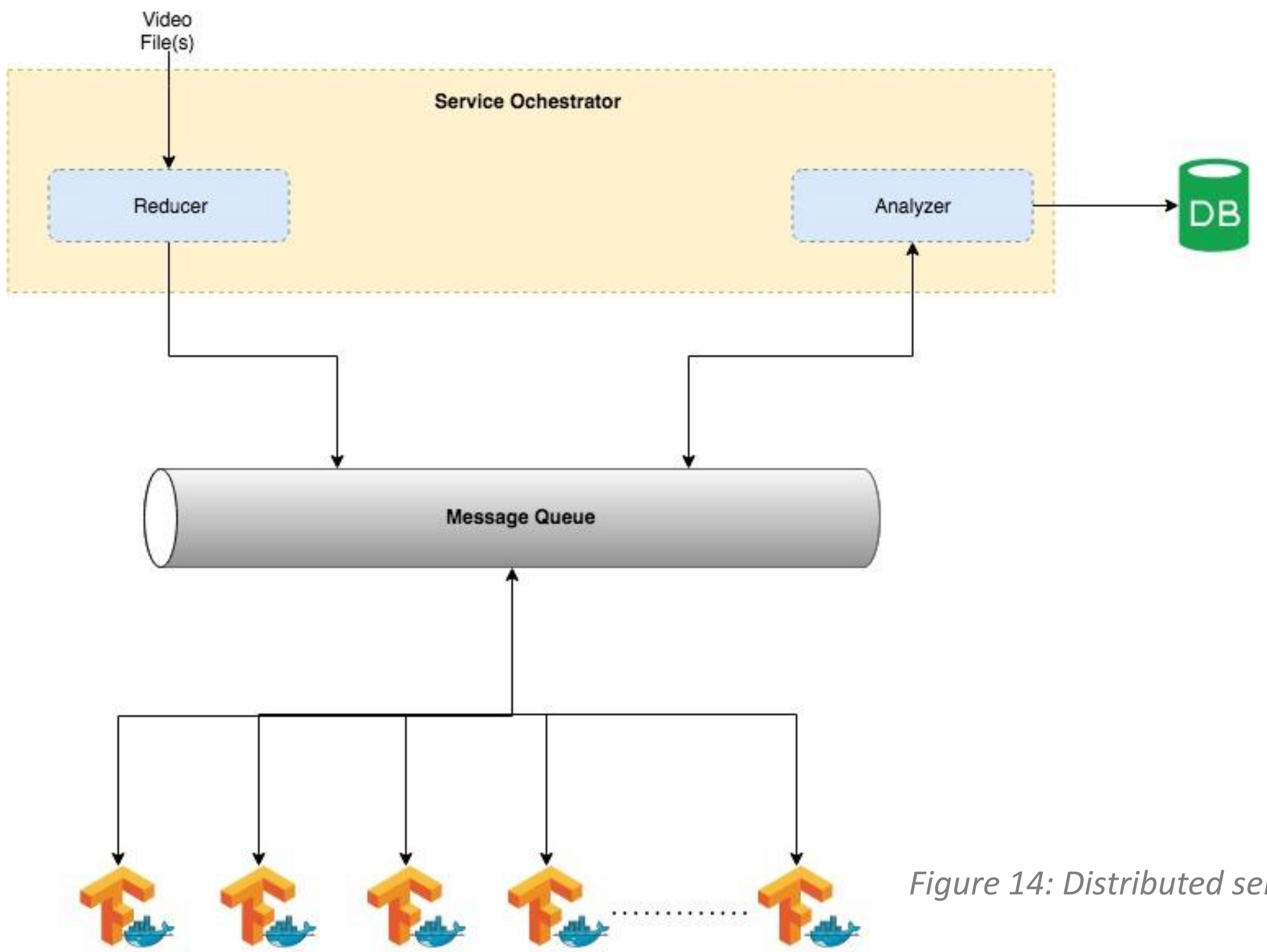


Figure 13: Shared memory orchestrator with distributed service workers

PARALLEL VIDEO CLASSIFICATION
APPROACH 2



- Use a Message Queue to direct work to classifiers
- Increase scalability
- Work progress is persistent

Figure 14: Distributed service workers and orchestrator with a message queue

WORK BREAKDOWN STRUCTURE

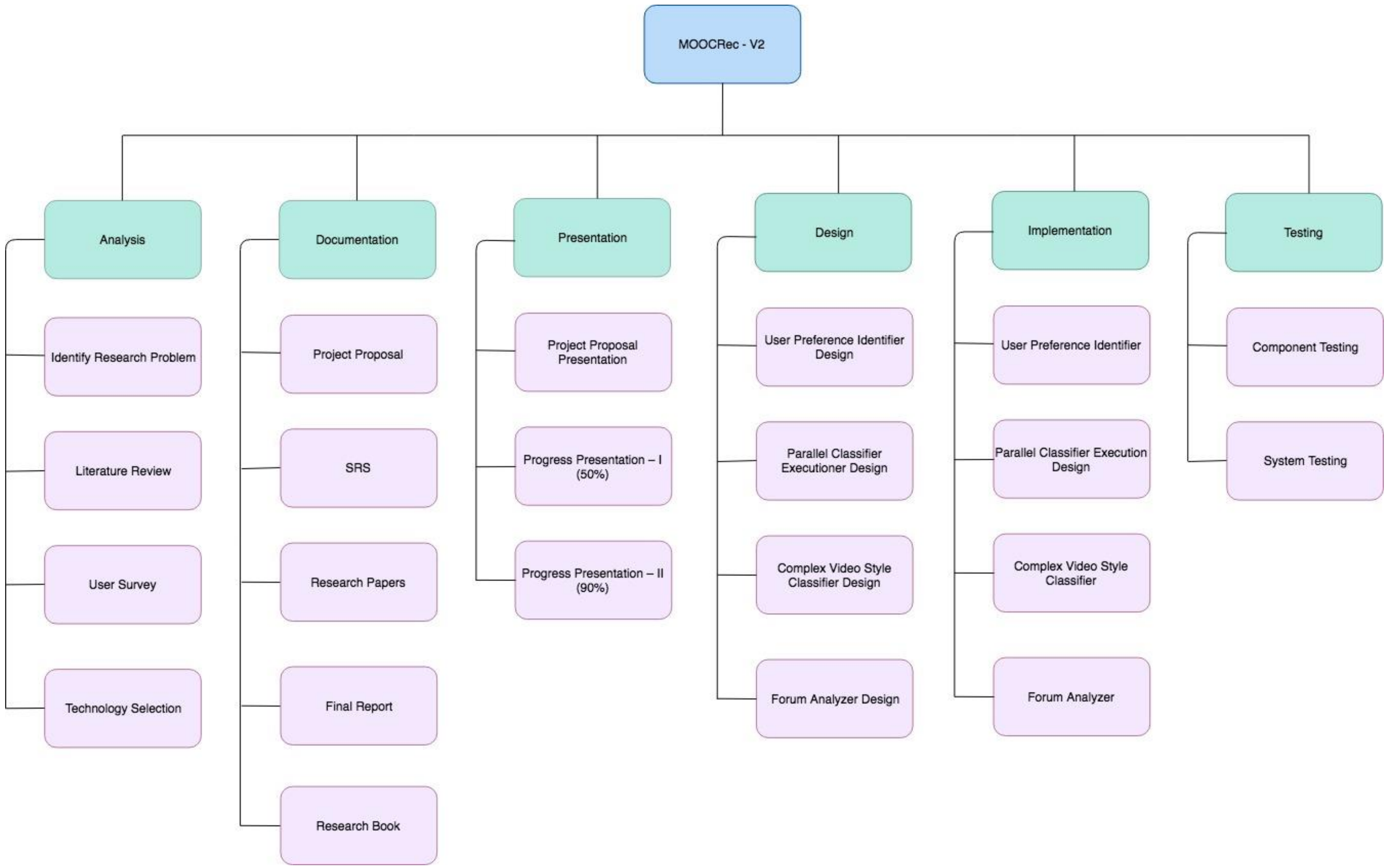
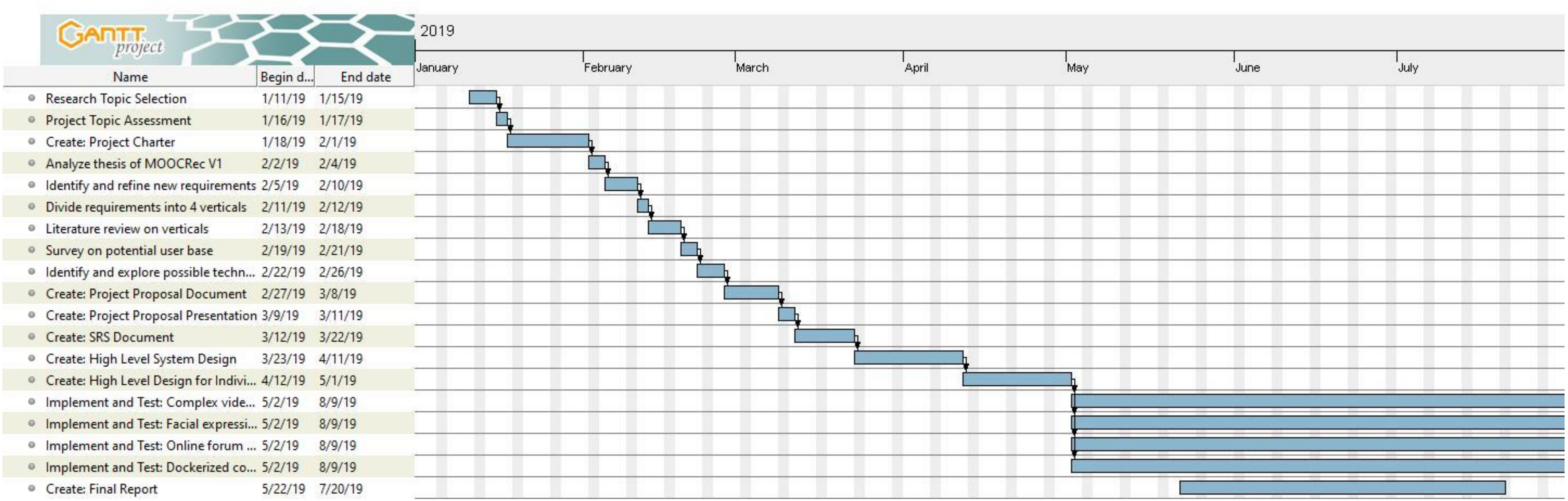


Figure 15: Distributed service workers and orchestrator with a message queue

GANTT CHART



Name	Begin d...	End date
Research Topic Selection	1/11/19	1/15/19
Project Topic Assessment	1/16/19	1/17/19
Create: Project Charter	1/18/19	2/1/19
Analyze thesis of MOOCRec V1	2/2/19	2/4/19
Identify and refine new requirements	2/5/19	2/10/19
Divide requirements into 4 verticals	2/11/19	2/12/19
Literature review on verticals	2/13/19	2/18/19
Survey on potential user base	2/19/19	2/21/19
Identify and explore possible techn...	2/22/19	2/26/19
Create: Project Proposal Document	2/27/19	3/8/19
Create: Project Proposal Presentation	3/9/19	3/11/19
Create: SRS Document	3/12/19	3/22/19
Create: High Level System Design	3/23/19	4/11/19
Create: High Level Design for Indivi...	4/12/19	5/1/19
Implement and Test: Complex vide...	5/2/19	8/9/19
Implement and Test: Facial expressi...	5/2/19	8/9/19
Implement and Test: Online forum ...	5/2/19	8/9/19
Implement and Test: Dockerized co...	5/2/19	8/9/19
Create: Final Report	5/22/19	7/20/19

Figure 16: Gantt Chart