

# DK PRACTICE : Dynamic Knowledge PRediction And eduCaTional Content rEcommendation system

## ABSTRACT

In the educational process, knowledge is built by studying various knowledge components or concepts using appropriate educational content. Today, a large variety of digital educational material can be found across the internet. Recommending the appropriate and personalized educational content aimed at the positive evolution of students' knowledge is a challenge that depends on certain critical points, including the student's knowledge state, the learning style, the ease of understanding or the difficulty of the subject. We propose an educational recommendation system, based on a recurrent neural network model which estimates the students' knowledge state from their responses to selected test questions. Our work in progress is to apply this proposed system to recommend educational material to students in a computer architecture course at the International Hellenic University in Thessaloniki, Greece.

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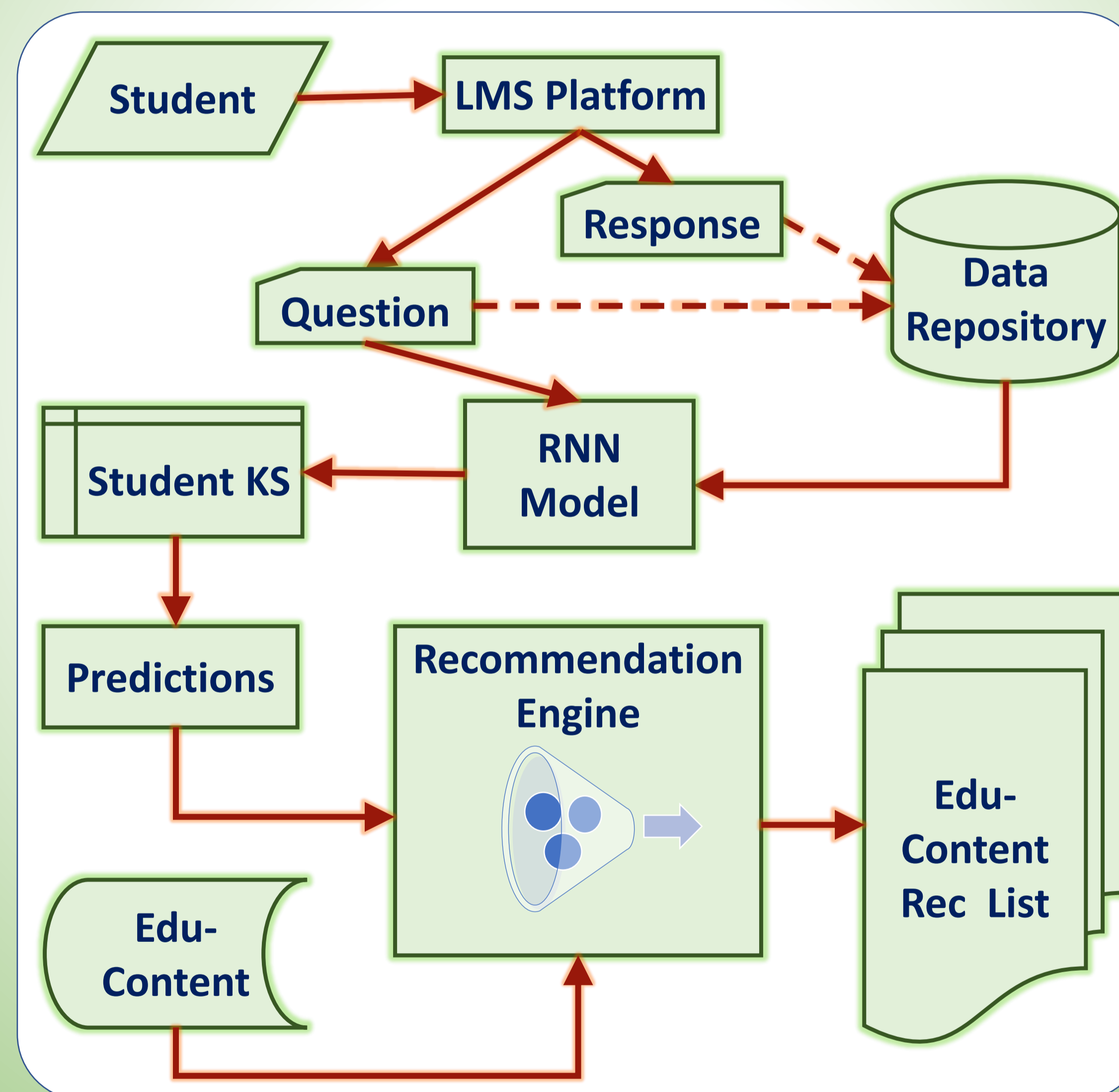
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## METHODOLOGY

We propose a recurrent NN model which is trained to dynamically estimate the students' current knowledge state (KS) using their history of responses. We then use the estimated KS to recommend specific learning materials in the concepts that, according to our predictions, the student has weaknesses and needs improvement. The data are from student responses to multiple-choice questions with only one correct answer and only one attempt to answer each question. The methodology for implementing the architecture of the educational recommendation system is:

- pre-processing of the data with anonymization and proper formatting
- training a dynamic recurrent machine learning model for knowledge state estimation and prediction of student performance
- recommending appropriate content, based on the matching probability between the estimated KS and the specific concept
- recording the users' evaluation of the recommended educational content
- offering an experimental plugin for a learning management system – LMS (e.g. moodle) to be evaluated on a computer architecture course in IHU
- testing the system's architecture

## THE MODEL



## INTRODUCTION

Knowledge tracing is the representation of the student's knowledge state in relation to certain concepts. The students' knowledge is modeled based on their responses recorded during testing in a learning management system. We propose a recurrent neural network model for the dynamic prediction of the students' knowledge state based on these records, which allows both students and tutors to understand the knowledge gaps or learning needs. The purpose of our study is:

- to improve the performance of students based on their past interactions (i.e. responses to test questions),
- to dynamically recommend appropriate, personalized educational content in a specific subject of study,
- to explore the student's knowledge before a test or as an auxiliary tool for the tutors to know the knowledge level of their students.

## CONCLUSIONS

We propose a Neural Network model for the recommendation of educational material to students based on their estimated knowledge state. The proposed model will be tested in an undergraduate Computer Architecture course via an experimental plugin in a major LMS. The recommendations will relate to the knowledge concepts covered by the course. The results of the system implementation will be presented in a future work after the data collection and analysis.

