Role of automation in enhancing the accreditation process of engineering education
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Abstract: This paper discusses two critical challenges associated with the accreditation process of engineering courses and outlines an automation-based approach to enhance the process. In largely populated countries like India and China, enormous amounts of engineering academic data, electronic and non-electronic, are generated every year. The most obvious solution for such a problem in any other industrial sector is automation of the process involving data collection and data analysis. The Indian engineering academic sector being slightly different from other industrial sectors, poses its own set of problems in automating the processes. One such problem being, the assessment of learning outcomes and accrediting the learning and teaching process. We believe a coordinated approach involving the concerned government bodies and a well-defined technical scheme to approach the problem from the grassroots level, would put the engineering academic sector at the forefront of adopting to the future. Here, we discuss a potential approach to contribute towards solving the aforementioned problem.

Keywords: Automation, Accreditation, Pedagogy, BigData.

1. INTRODUCTION
Data automation, BigData, Hadoop have been the buzz words in the recent days. Academic sector is no exception to the implications of flooding of digital and non-digital data, after each cycle of operation [1, 2]. Accreditation of the academic institutions and programmes has been a quality assurance approach since long and has proven to be progressive and developmental.

In 2012, the president of Council of Higher Education Accreditation (CHEA), Judith S. Eaton had pointed out the high impact of technology on the collegial model of education and accreditation [3]. The observation of the technological impact in [3] made way back in 2012 has proven to be correct and more;

The pedagogy of different countries has evolved very differently because of various historical reasons and it makes the accreditation process a bit skewed from country to country. However, the increasing acceptance of mutual international agreements like Washington Accord, Sydney Accord and Dublin Accord in accreditation of engineering programmes, is a positive sign towards global convergence to one standard of teaching/learning methodology and accreditation of engineering programmes. National Board of Accreditation (NBA), India has gradually moved to a more stringent process of accreditation post 2004 [4]. The number of variables has decreased and the threshold level for categorization and accreditation has increased, this is another positive sign [4]. The ingress of ICT in Teaching, Learning and Academic data storage has become not only enormous but hugely diversified [1]. Hence, it makes all the more a need of the hour, to put together all our efforts to converge the operations of Academic institutions, Accreditation bodies and the National/International Governing bodies. In this paper we briefly deal with two critical technical challenges from academic data management and engineering pedagogy perspective and then propose a solution based on data automation, keeping international standardisation as the basis.
2. CURRENT TECHNICAL CHALLENGES

Reasons for the NBA accreditation: quality, consistency and continuity along with measurement of the “course” based on certain set criteria. This measurement leads to standardization so the students get consistently the same “inputs” to become better professionals and citizens.

The two major technical challenges in engineering education sector with respect to academic data management and accreditation, especially in India, can be listed as follows:

2.1 WIDE VARIETY OF EQUIVALENT QUALIFICATIONS

The plethora of offerings from various institutions recognized by different agencies such as UGC, AICTE, etc…, does not reflect on the students being of the same quality output and becomes that much difficult to measure.

In India there are a good number of equivalent undergraduate degrees in engineering. For example: AMIE degree which is owned by Institution of Engineers (India) incorporated by the Royal Charter pre-independence has only 9 theory papers with lab work and project. AMIE is recognised by Ministry of Human Resources and Development (MHRD) and other national bodies. Even though the BE students study 50+ subjects with 14+ labs and 2projects, AMIE is considered et par with BE.

The simplest but most difficult solution for this challenge would be to scrap all the current degrees, keep only one and converge other degrees to the same. Since, BE-BTech is approved by AICTE, AMIE and Bachelor of Science (Engineering) is approved by University Grants Commission, it is nothing but impossible to convince these bodies to scrap the degrees.

2.2 LARGE DEPENDENCE ON SUBJECTIVE INTERPRETATION

The competitive examinations at national and international level have migrated to objective and adaptive examinations to avoid subjective bias, which may not be a fair evaluation. For example: Graduate Records Examination (GRE) owned by Education Testing Services and recognised by many countries for their post graduate examinations uses a completely adaptive and machine based testing of objective (multiple-choice) and subjective (essays) questions thus making the assessment ‘fair and consistent’ to the highest levels. And further added to the fairness, the GRE score is normalised, which makes it even more consistent.

Though, the method of subjective interpretation has been historically accepted and led society to where it is, a change in the assessment is the need of the hour keeping in mind the large amount of data.

We believe that the aforementioned challenges require a great deal of social and political ‘will’ to solve in a stipulated timeframe but use of data automation would be the most effective tool and probably the best tool, such a positive ‘will’ to action. In the next section of the paper, we describe why and how data automation can help in resolving the listed technical challenges.
3. AUTOMATION BASED NORMALISATION

In this section, we provide an outline and solution scheme involving automation to solve each of the technical challenges listed in section 2. The solution scheme has been proposed at a generic scale, these solution schemes form basis for an effective engineering academic data management strategy and aid in accreditation of engineering programmes in a uniform manner at national and international levels.

3.1. WIDE VARIETY OF EQUIVALENT QUALIFICATIONS LIKE BE, BTECH, AMIE, BS ETC....

This challenge can be categorized as a quantity challenge. The process of analysing the nature of programme and the associated parameters becomes a cumbersome exercise to accredit the programmes on a normal scale. We propose a solution scheme as shown in Figure 1 to counter this challenge.

The solution scheme in Figure 1 addresses the issue of variance of qualifications with the effective use of Data automation and normalisation. The basis of implementation for such a scheme is that the algorithm for the scheme can be a generic algorithm as a good amount of commonality is expected between different types of equivalent qualifications in the same specialization. The algorithm needs to ignore the insignificant data and normalize the raw engineering data to a predefined template that could be mapped with the template generated using another generic automation algorithm specific to qualification type and specialization.

3.2. LARGE DEPENDENCE ON SUBJECTIVE INTERPRETATIONS OF STUDENT AND QUALITY ASSESSMENT

The aforementioned challenge can be categorized as a quality assessment challenge. The population increase and the increase in the number of people undertaking higher studies has further loaded the global academic data repository. One of the solutions to counter this challenge is by using objective assessment methodology, used by most of the National and International competitive examinations like CAT, GATE, JEE, SAT, GRE, GMAT etc... The greatest drawback of an all objective assessment is the lack of testing in human faculties like creative thinking, group work, empathetic behaviour, emotional quotient etc... Though, engineering education is more of technical in nature, still the human faculties are to be given due consideration. Artificial Intelligence (AI) and Machine Learning (ML) are catching up at a very high speed even onto emotional faculties but we still feel they are way too behind in reaching the efficiency and complexity of human brain with respect to both ‘Hardware’ and ‘Software’! We also feel such aspects, not just cannot be but should not be replaced using AI & ML:

Hence, this challenge can be best solved by universalizing the examination content by categorizing assessments into objective assessment and subjective assessment involving practical work wherein the human faculties can be indirectly assessed in an objective manner.

For example: How fast can one computer program achieve the objective than another program achieving the same objective, this quantifies the creative implementation of logic and algorithm performing better than the other. Data automation can be best utilized in this regard.

A specific course hosted on www.edx.org mandates hands-on project using a development board and the weightage given to hands-on work is 50%. The screenshot of the development board outputs after each stage of development has to be uploaded on the portal and the images are analysed.

The method used to analyse the output images is not mentioned on the website; however, we strongly believe image processing algorithms can be implemented to analyse the outputs thus automating the process. Finally, a generic scheme can be outlined as depicted in Figure 2.

**FIGURE 2: AUTOMATED NORMALIZATION OF ASSESSMENTS WITH SUBJECTIVE AND OBJECTIVE COMPONENTS**
CONCLUSION

In conclusion, we feel that automated normalisation is a very effective way to counter the critical challenges in the field of engineering education and it helps a lot in the process of standardisation and accreditation.

REFERENCES


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Dr Ravichandra has a total of 8 years of teaching and research experience, he is an enthusiastic academician and has taken the academic profession by choice. He has done his PhD in Engineering from AUT, Auckland NZ and has a stint of industrial experience post-PhD.

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Dr Mahesh Rao got his BE in Electronics and Communication, First class with Distinction, from Sri Jayachamarajendra College of Engineering, University of Mysore in 1981 and then went on to do his Masters in Applied Science, Electrical Engineering from University Of Windsor, Canada in 1984. Then completed his PhD from University of Wyoming, Laramie in 1988 in Electrical Engineering specializing in 3-D actuator design and control for Robots. He worked as Assistant Professor for five years at University of Reno, Nevada (1987 to 1992) and then Joined Intel as Technical Support Manager in 1992 (Sacramento USA). Then he became Validation Manager for Intel Chipsets and the Program Manager for Integrated Microprocessors.

He was recognized with Intel Achievement Award for his contributions to the Chipset development. In 2000 he returned to India as General Manager for Intel Bangalore. He then started his own Company, Aspire Communication in 2002 at Mysore which employed more than 600 engineers by 2011.