An Improved Textbook Marketing Strategy with Recommended System Based on Collaborative Filtering

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ABSTRACT

Textbook prices have always been an important parameter in determining student's academic performance and experience, they have the potential to impact not only how well a student is able to understand concepts and perform in their assessments affecting their grades but also as a result mar their prospects of performing well in their chosen fields and obtaining jobs. Textbook prices have increased unabated because the textbook market lacks two major economic forces.

- Normal Market - Competition in the market forces prices down
- Textbook market - Major publishers control majority of the market, locking out competitors
- Normal Market - Consumer choice rewards companies that compete on price and quality.
- Textbook Market - The student – the consumer – has no choice in which textbook they're assigned

Recently, publishers have increased cost-saving options like e-textbooks. Rental programs and used book markets are alternative consumer-friendly options to new books. However these used book markets are still not able to safeguard students as when students go to sell their used books, the books are priced at extremely low, next to nothing prices compared to their high original prices. This pricing is done on vague ambiguous parameters which depend upon the whims of the shopkeeper deeply undercut the student and prevent him/her from regaining any value back from the book thereby defeating the whole purpose of the resale market. This paper

expounds upon such underlying difficulties faced by students and presents an idea which will prove useful in combating such difficulties.

Keywords – high price, textbooks, student, resale market, unique platform, recommender system, collaborative filtering.

INTRODUCTION

Textbook costs have increased rapidly in recent years. College textbooks remain one of the largest out of pocket expenses for students and families – meaning that high price tags are yet another threat to affordability and accessibility of higher education. The average cost spent by a student then amounts to high percentage of the whole tuition fees they pay for their education to their institutions. The underlying cause for high prices comes from a fundamental market flaw in the publishing industry. Due to this, students is, are in essence, a captive market. Without the ability of the student to choose a more affordable option, publishers are able to drive prices higher without fear of repercussions.

Some common practises used by publishers to drive rates are –

- New Editions – The practise of rolling out new editions is fairly common but effective one, publishers release updates new editions of popular textbooks, which are more expensive than the previous editions, to perpetuate the illusion of added quality and features. These new editions are released every 2-4 years regardless of any changes in the subject. Once these new editions hit the markets they slowly replace the old editions on the bookstores forcing students to buy the new, more expensive editions.

This also affects the resale markets as once the new edition are rolled out the bookstores are obliged not to buy back the previous old editions preventing the students from selling their books of previous semester. The new edition only slight changes such a shuffling of the contents, varied order of page numbers making it difficult for students with old editions to follow.

- Bundles – Prices of textbooks are also increased by selling the books packaged with online pass-codes, CDs or activation codes. These individual singles use codes grant the buyer access to online homework assignments or supplementary material related to the subject. These codes, passwords increase the price of the textbooks by 10-50%. Often the students are required to have these online codes for one or more of their courses. The codes are single use and are not sold separately from the textbook, meaning that to get access the students are forced to buy new versions every time. This also means that the bookstores can't buy back or resell the book.
- Custom Editions – Often the publishers market 'custom editions' of a textbook, these custom editions are marketed as more affordable and are often published without binding or in black and white. These are especially appealing to the faculty as they allow them to arrange the section of the books according to their own convenience. Though these are marketed as affordable they actually aren't as these customize editions have no resale value.

IMPACT ON STUDENTS

During a 2013 survey done by Student PIRGs [1], the findings were –

- High textbook costs actually discourage students from buying their assigned material despite a concern for their grades.
- These high costs have a ripple effect on other academic decisions of students.
- Students expressed need of alternative options, like textbooks that are available free online and buying a hard copy is optional.

In 2015 a survey was conducted by the Student PIRGs [2] around textbook affordability and financial aid, where in questions financial aid was defined as grants, scholarships and loans (not including money from parents or family). Here the results showed –

- A considerable number of students turn to financial aid to purchase their required textbooks and course materials.

BOOK BUFFET

Used book and resale market have been able to provide some to the students but they can only do so much in depressing the cost in a publisher controlled market. Openly licensed educational resources have the potential of providing a powerful alternative parallel path that challenges the current trend. It holds the potential to mitigate the current affordability crisis however little work has been done in promoting this solution and its universal adoption across the all educational institutions is a reality that will take many years to realize. As an attempt to provide a viable solution that has no such obstacles in its adoption, this paper introduces a platform that will empower students and take control of the market back from the publishers and potentially revolutionise the resale book market.

Book Buffet is a platform that enables the students to buy and sell the books that they need among themselves without any third party intervention. A student can post any book that he is willing to sell and any willing student who expresses an interest in the book that has been posted can communicate with the person directly. This also enable the buyer and the seller to have an honest conversation about the price of the books that has been posted and allows the buyer an opportunity to convince the seller to lower the price according to the condition of the book in question. This idea though exceedingly simple has the potential to deal and provide a solution for several aspects of the problems that the students face.

This platform also provides the students a new way of finding connections and acquaintances in a new and unknown college environment.
Students will be able to find people who textbooks, course materials that cater to their area of interest and will help find guidance and companionship in the path of excelling in their chosen field.

CHANGING THE RESALE MARKET

Used and resale book market is currently totally controlled by the stores. Any book which the student brings to sell is priced according to ambiguous parameters that slash that price of the book to a tiny remnant of their original price.
Some of these parameters are the edition of the book to be sold and the quality of the book, however there are no specific metrics that correctly tell a student how such aspects affect the price of his book and what can he expect to get in return. This platform will remove such middlemen and get students fair and satisfactory prices for their books.

OUT OF ACADEMIC SPACE

When zooming out of the educational institutions space this platform can provide users the opportunity to find textbooks and educational resources they need or are interested from people near them at reduced rates instead of going and buying brand new textbooks at exorbitant prices. This platform can help people in places where connectivity to the outside space is not much and there is not a solid infrastructure between bookstores and suppliers, due to various underlying conditions, rendering them unable to keep relevant book stocks spanning across several topics and fields. In places like these, just with the presence of an internet connection people can contact other people through the books posted by them on the platform thereby quenching their thirst for knowledge overcoming the challenges they face.

SCOPE

Recommendation systems are an essential part of any platform looking to provide any service to users, in this day and age where customization according to user's preferences is a non-negotiable feature. Collaborative filtering is a very successful filtering system and it is used widely, it is based on user's historical preferences on a set of items. This system use statistical techniques to find a set of customers known as neighbours, that have a history of agreeing with the target user (i.e., they either rate different products similarly or they tend to buy similar set of products). Once a neighbourhood of users is formed, these systems use several algorithms to produce recommendations.

The standard method for Collaborative Filtering is the Nearest Neighbour algorithm. So there are m customers represented by the list C = $\{c_1, c_2,...,c_m\}$ and n products represented by the list P = $\{p_1, p_2,...,p_n\}$. Each customer c_i expresses his/her opinions about a list of products. This set of opinions is called the "ratings" of customer c_i and is denoted by P_{ci} . There exists a distinguished customer $c_a \in C$ who is called the active customer the collaborative filtering algorithm is trying to find a product suggestion. To predict the rating r_{ij} where the target user has not yet rated the product j, is done by calculating similarities between target user i and all the other users and selecting the top X similar users and taking the weighted average of rating from these x users with similarities as weights.

$$r_{ij} = \frac{\sum_k Similaries(u_i, u_k) r_{kj}}{number\ of\ ratings}$$

Equation 1

Since different people have different baseline for ratings, to avoid this bias we can subtract each user's average rating of all items when computing weighted average, and add it back for target user, shown as below.

$$r_{ij} = \bar{r}_i + \frac{\sum_k Similaries(u_i, u_k)(r_{kj} - \bar{r}_k)}{number\ of\ ratings}$$

Equation 2

The main goal of neighbourhood formation is to find, for each customer C, an ordered list of k customers N = $\{N_1, N_2,...,N_k\}$ such that C does not belong to N and sim(C, N_1) is maximum, sim(C, N_2) is the next maximum and so on, Where sim(C, N_i) indicates similarity between two customers, which is most often computed by finding the Pearson-r correlation between the customers C and N_i. There are two ways of finding out similarity namely Pearson correlation and Cosine similarity.

$$Pearson\ Correlation: Sim(u_i, u_k) = \frac{\sum_j (r_{ij} - r_i)(r_{kj} - r_k)}{\sqrt{\sum_j (r_{ij} - r_i)^2 \sum_j (r_{kj} - r_k)^2}}$$

Equation 3

$$Cosine\ Similarity: Sim(u_i, u_k) = \frac{r_i \cdot r_k}{|r_i||r_k|} = \frac{\sum_{j=1}^{m} r_{ij} r_{kj}}{\sqrt{\sum_{j=1}^{m} r_{ij}^2 \sum_{j=1}^{m} r_{kj}^2}}$$

Equation 4

This system produces recommendations that can be of two types –

- Prediction which is a numerical value R_{ij} , which shows the predicted rating of product j for the active user i.
- Recommendation is a list of n products, $TP_r = \{T_{p1}, T_{p2}, ..., T_{pn}\}$ that the active user will like the most.

Figure 1 represents the schematic diagram of the collaborative filtering process. Collaborative filtering

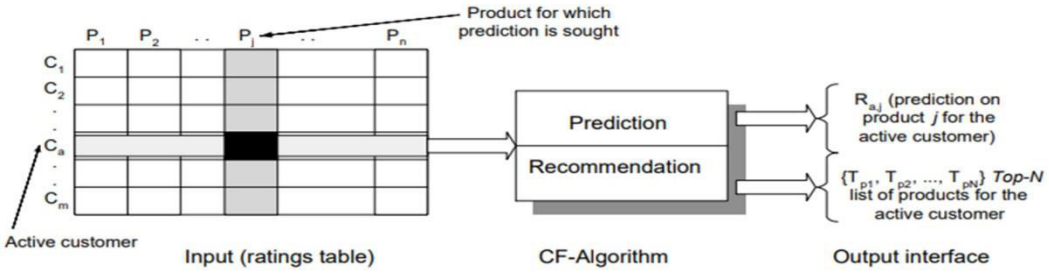

Figure 1

algorithm represents the entire m x n consumer product data as a ratings matrix A. an entry $a_{i,j}$ represents the rating of ith customer in regards to the jth product. Each individual rating is within a numerical scale and it can be 0 meaning that a customer has not yet rated that product.

CONCLUSION

Textbook prices appear small in comparison to the larger costs of the whole tuition, room and board hence they are overlooked and the whole situation is accepted as a part of reality of the educational world. This in turn results any action in addressing the problem being deprioritised leaving students to fend for themselves and taking it upon themselves to find workarounds to the situation. This situation only serves to increase economic hardship on students and affect student success in the academic field.

In this paper we introduce an innovative platform that serves to put buying and selling power in students' hands, where students can buy and sell textbooks among themselves directly.

- Students get fair prices for their textbooks.
- Students can get textbooks at reasonable prices from their fellow students.
- An honest discussion about what the fair price of a used textbook should be.

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