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Developing CRIS module for technology transfer

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Abstract

We present a web service to find prevailing royalty rates. The service is intended to facilitate technology transfer by suggesting payment scheme when prospective licensee looks through the results list on the webpage of the research information system or technology transfer office. New suggestions are generated according to the special step-by-step algorithm that exploits pre assigned licensor's information and the licensee's expectations Both licensor and licensee provide their expectations to the program mediator that processes it and returns only royalty rates as a result. So the parties do not share complete information – they exchange only information about royalty rates just the same way as in common negotiations. Step-by-step procedure guarantees the utility improvement for both parties only if the true preferences are revealed. This web service was tested with Share Point based information system.

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Keywords: technology transfer; royalty rate optimization; web service

1. Introduction

Scientific results contribute much in our understanding of the World we live in. For some of them the practical value is obvious – one can easily point out a variety of useful applications and build a clear development scheme needed for the results to yield ready for market products and services. Further technology development requires special skills and resources, often not available to researchers. There are two basic ways to improve technology and reach the commercial application – the research group accomplishes all the tasks by themselves or enters into an agreement of different types. The first way requires the researchers to spend more time on design, marketing,

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financial and legal activity while fundamental scientific problems are paid less attention to. Rare researchers agree to such drastic changes in their career considering the above mentioned activity to be secondary. They are likely to delegate non-core activity to the interested professionals solving the related scientific task. This is the case when technology transfer comes to light.

There are many technology transfer methods, but onlylicensing the special case of technology transfer is a framework of this paper. Some universities have information on ready to license technologies on their websites (see http://technologylicensing.research.ufl.edu as an example). Industry representatives could meet available scientific results and decide whether they promise some commercial value. On the other hand information systems with the feature of research results dissemination are known and they serve to inform industry about modern developments (SK CRIS and NASA as the examples). Some organizations go further and place the intellectual property policy and license agreement guidelines on their websites. This information allows potential licensee to get an idea on license agreement terms and potential constraints. The most notable example of information technology usage in licensing demonstrates The Pennsylvania State University (USA). A special web-site was introduced to secure patents Internet auctions (https://patents.psu.edu/). One can see all the results available for licensing, legal documents, agreement drafts and actual bids. So the intent and various attempts to support technology licensing are obvious – information systems and web-sites disseminate ready to use results, licensing policy is announced by research organizations, the willingness to communicate with industry through the Internet is demonstrated.

Strong information technology exploitation in licensing inspires to think on how the software tools and web-based services could facilitate the technology transfer. We describe a service that could be integrated into institutional CRIS (Current Research Information System) for leveraging technology licensing. The service under discussion suggests both parties – licensor and licensee – to vary royalty rates and to find better terms of license agreement. The contract terms – the subject description, licensing period, usage domain, territory, etc. – could be in general, but the licensee could wish to change the price. The service allows her to alter royalty rates in some range to find better payment scheme. The room for payment optimization lies in an opportunity not to fix royalty rate during the whole period, but to set unique value within each period. So, it could be better to decrease rates in some periods while increasing them in the other ones. For the underlying mathematical mechanism the Pareto optimality is proved.

2. Model description

The model situation stated as follows. A licensor (say, university for clarity) owns some technology and is ready to make an agreement with potential licensee. The purpose is to reach as wide circle of potential contractors as possible. As expected the wider range more probably yields license agreement. While promoting technology licensor aims at both clear subject description and less information disclosure. The first issue suggests more or less complete material on technology specification and deal terms, so search efforts would be minimal and potential licensee finds the proposition much sooner. The second issue prevents information leakage, so much of know-how and operating parameters stay with the licensor until an agreement is signed. License reward is running royalty only calculated as a percentage of licensee's gross revenue. Also suppose all agents – licensor and potential licensees – have some range for transaction price – royalty rate – to be varied. This assumption means that every agent has some maximal and minimal values for those rates, when an agreement is negotiated. One of the main problems in licensing is the royalty rate calculation. And we deal with the task of a flexible tool development for promotion and conclusion license agreement.

Communications network provides good opportunities for interaction and making a deal under information asymmetry. Transaction price is a question of economic efficiency of the technology under discussion. Of course, the expected by an agent royalty rate is subjected to various factors, but undoubtedly it depends strongly on the agent's conjectures and preferences, that constitute private information. For example if licensor anticipates considerable cost savings to the licensee because of technology exploitation he expects higher reward. In general, private information remains to be closed while the counter party observes only a signal about the information. Network promotes different methods development in order to generate offers and counteroffers during negotiations (see Faratin et al.[2], Huang and Sycara[3] and Saha et al.[7] as the examples). Under information asymmetry the main idea is to somehow learn the counter party's preferences. We rely on completely different idea – at each negotiation

stage a party should always choose the best offer in presence of some program mediator. That mediator could stimulate parties to provide more precise signals. An example of the method with program mediator could be found in Ehtamo et al.[1]. If an agent is sure that mediator does not store private information and does not disclose it to the counter party, he would agree to reveal more signals. Thus, what we need is program mediator, that 1) processes signals, 2) does not store private information, 3) reveals only processed data constituting the common information – royalty rates.

2.1. CRIS case

Such a mediator could be implemented as an application that utilizes some data stored in CRIS (institutional or national). The mediator is software that could be a part of CRIS server or to be located at physically separated server and communicated through the web. For clarity consider program mediator to be a web-application the CRIS addresses to in order to optimize royalty rates. A licensor announces terms of issuing a license on the website and fills special form. This form contains all the clauses and economic parameters that will be used later to build the best offer to potential licensee – field of application, expected revenue, license period, discount rate, minimal and maximal royalty rate, initial royalty rate. The economic expectations could be set for each application field. The website displays a list of research results available for licensing. Users could see the list as a whole as well as sort results and observe information card with technical specification and suggestions on its application. We do not specify the website location – it could be a part of CRIS or hosted by third party. What does mean is the website acquires data on research result from CRIS. For clarity suppose the website is hosted by university technology transfer office – it aggregates results from institutional CRIS, and holds economic data provided by the licensor that remain to be private and tot publicly available. So the website relies on CRIS engaging data from complementary sources. Web-application for royalty rate optimization acquires research result's ID, licensor's ID, economic data and license agreement template. These data would be used later while varying royalty rates and preparing license agreement.

The website users navigate the research results and examine the detailed description from information cards. If the website visitor interested in particular technology after seeing license terms wants to vary royalty rate, she activates special form for entering her economic expectations, similar to those provided by the licensor: expected revenue, costs, discount rates and investments. Through the form submitted data are transferred directly to the web-application for royalty rate optimization and compared with those of the licensor. Economic expectations from the both parties reflect the subjective value attributed to the exploitation of the technology licensed. If the licensee for example expects high turnover in the first periods, she prefers smaller rates at the beginning and higher at the end of the agreement compared to uniform royalty rate. Licensor, otherwise, could be better off with higher rates at the beginning and the smaller ones at the end of agreement duration. But information asymmetry does matter in bilateral negotiations. Parties do not know opponent's expectations precisely, so one could expect more profitable periods at the beginning while his opponent expects higher revenue at the end. These expectations correspond to preferences of each party. When placed in the particular conditions an agent has preferences on changing clauses to become better off. Preferred royalty rates define the cone of preferences for each agent. The knowledge of those cones allows calculating the rates "exchange" among periods, and corresponding payments distribution between parties. We take the word "exchange" in quotas because in mathematical space of royalty rates it looks like exchange, but economic interpretation is not so rigid. It is more correctly to tell about suggestion to decrease rates in some periods while increasing them in others.

The machine calculates a new offer based on the distance minimization between parties' preference cones and demonstrates the calculated royalty rates to the users. Important issue is that licensee's data are not stored in the any part of the CRIS. While seeing new royalty rates potential licensee could change some terms and submit data again. This is step-by-step procedure that leads to the better contract terms and it is followed by license agreement or abandonment. The result of procedure is the Pareto optimal set of royalty rates in different periods within license agreement duration. The ground for royalty rate optimization is the opportunity not to fix them during the entire license period but to set unique rate for each year. So decreasing rates in some periods with the simultaneous increasing them in the other one could generate better offers. The procedure of the distance minimization between two cones in mathematical space implements the formal rule that is used to propose such offers. The proof of

algorithm convergence to the Pareto-optimal royalty rates is presented by Kozyrev and Nevolin[4] and the prototype is implemented as a web service.

Such an approach, when dealing with preference cones instead of utility functions, has some significant advantages. In general, researchers deal with some analogue of utility function (say, profit for example) and calculate royalty rate maximizing utility subjected to various constraints corresponding to model setting. The idea could be found in Macho-Stadler et al.[5]. Preferences cones reflect the behavior of negotiating agents we observe in real deals. People rare know the full list of constraint, and new restrictions appear as long as negotiations proceed. So one can get a proposition, fill new constraints to become active and slightly correct terms, suggesting counter-offer. On the other hand, when stating counter-offer, one does not reveal his constrains or utility function. Counter party does not observe all the expectations and opportunities of an agent. This is what the web-application under discussion does – it suggests only royalty rates as an offer, while holding economic data in secret. So the approach under discussion guarantees the safety of private information and stimulates to state true economic expectations – otherwise, the machine generates royalty rates that could be worse off. The approach guarantees the utility increase only if the party provides true information. Both licensor and licensee provide their expectations to the program mediator that processes it and returns only royalty rates as a result. So the parties do not share complete information – they exchange only information about royalty rates just the same way as in traditional negotiations.

2.2. The module implementation and further development

At the moment a prototype of technology transfer service is developed. SharePoint based system stores a list of ready for market results. User is able to navigate the list and read detailed description of each item. The description contains technical details, base royalty rate and sample license agreement. In case of interest user can press special button to modify royalty rates. When the button is pressed an input form appears. User is asked to enter expected production, price, costs and discount rates. After the form is submitted service calculates new royalty rates proposition based on licensor's economic parameters and royalty rate thresholds for maximal and minimal values. All the licensor's data are stored in the information system. The royalty rate optimization application is realized as script on the remote server and communicated by means of Internet. Results of the calculation are shown in visual form as a diagram of rates' modification as well as the list of the suggested payment schemes. User could modify her expectations after calculations and submit form again – all the payment schemes previously calculated are presented in the list, and user could choose one of them to make a deal.

Further action when user chooses the payment scheme and agrees to make a deal could be undertaken according to the goals of licensor or CRIS owner. For example user confines only by sending her contact to the licensor. Or she could be asked to provide her legal and contact data to generate a license agreement. When the license agreement is generated its view with the payment scheme chosen could be suggested to the user. Or user's details could be associated with the particular technology and research results to inform about their exploitation. It could be even useful to inform licensor about page views and drops while going into detailed description and varying royalty rates. This information could be used to correct a proposition. All these data on getting familiar with the particular results could be used in research results assessment – they correspond to new approach to the measurement of research results usage, that described by Parinov and Kogalovsky[6].

Hypothetically, the service under consideration could be integrated with Russian information system SOCIONET that stores not only fundamental scientific results, but also applied ones, such as inventions, software, etc. The system stores semantic links between different objects (authors, organizations, results, etc.) and being integrated with the royalty rate optimization service it could be extended to store some additional information on result usage – the licensee data as well as the overall number of attempts to vary royalty rates by interested users. The adoption of the web service requires some technical tasks to be solved – in particular, the interface between the service and the system should be coordinated. So far the service exploits data stored in different files. When considering the SOCIONET system. The entire infrastructure is ready – the system is CERIF (Common European Research information Format) compliant, operates with the different entities and is capable to communicate with different modules. So the interoperation remains to be set up.

3. Conclusion

The service considered relies strongly on CRIS attracting the data from different sources. CERIF suggests useful structure information format, conveying a vast of entities used in licensing deals: result, person, organization. Patented inventions are also covered by the format. But some necessary data are absent: economic data and results of very important type – know-how. The reason is that CERIF provides format for purely research systems, one shouldn't be enthusiastic on extending it to technology transfer objectives. Economic data on results exploitation has little in common with the research promotion and know-how demonstrate some contradiction to the scientific activity – to gain and disseminate the knowledge. But technology transfer professionals could think about prospective collaboration with research institutions to interconnect information systems for supporting automated tools development, facilitating technology transfer. As the service operates on remote server one could use to development a single platform for technology market aggregating data from different institutional CRISs. Platform implements all the commercial activity and holds necessary economic data, importing the information on research results from separate CRISs. Institutions also get some advantages. First, the enhanced results transfer to industry. Second, CERIF-compliant CRIS could use feedback from technology transfer service to introduce some indicators on results impact. Indicators could rely on the number of page views, number of potential licensees (users who tried to vary payment scheme) and the value of royalties. Data on drops during payment scheme optimization also could be used in correcting the initial proposition on technology licensing. Third, as CERIF-compliant CRIS interconnects different entities it becomes easier to calculate author's reward. The royalty rate could be associated with the particular result. The letter in turn is associated with the author and his share could be calculated automatically.

So, one could conclude that the service described suggests convenient tool for interested parties – researchers, technology managers, industry representatives and society.

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