**香 港 中 文 大 学（深 圳）**

**THE CHINESE UNIVERSITY OF HONG KONG, SHENZHEN**

**Undergraduate Research Awards**

**APPLICATION FORM**

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| Name  (In English): Shulin Ke | 姓名  ﹝中文﹞: 柯舒麟 | 性别  Gender: 男 |
| 学号  Student I.D. No: 119020022 | 学院  School: SME | 主修/课程  Major /Programme: Financial Engineering |
| 电子邮箱  E-mail: 119020022@link.cuhk.edu.cn  联络电话  Phone Number: 13338466985 | 修业年  Year of Attendance: 2  累计平均成绩  Cumulative GPA: 3.49 | 预期毕业年份/学期  Expected Year / Term of Graduation: 2023 |

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| 研究项目 | | | | | |
| RESEARCH PROJECT PROPOSAL | | | | | |
| 题目 | | Incentive Mechanism Design On Blockchain Storage | | | |
| Title of Proposal | |  | | | |
| 描述 | | | | | |
| Brief description  *This part is suggested to be written in English, except for special requirements.*  I decide to publish this paper in the conference INFOCOM 2021 this year corporate with Dr. Yunshu Liu who is now studying in CUHK Shatian Campus. Yunshu Liu will be the first author of this paper while I will be the second author together with Zhixuan Fang, Man Hon Cheung, Prof. Wei Cai, and Prof. Jianwei Huang as the third, fourth, fifth, and sixth author. Here’s the abstract of the paper which illustrate the topic:  “The booming of blockchain systems leads to significant storage cost for miners, which is difficult to cover by users' transaction fees. Such a phenomenon may jeopardize the blockchain security in the long-run. In this paper, we propose an incentive mechanism to alleviate this insufficient-fee problem in delay-insensitive blockchain applications by adjusting the transaction time limit, which is an easily implementable modification to the blockchain protocol. Specifically, we model the interactions among the protocol designer, users, and miners as a three-stage decision process. In Stage I, the protocol designer optimizes the time limit to maximize the social welfare. In Stage II, each user adjusts his transaction generation probability and transaction fee to maximize his payoff. In Stage III, each miner selects a transaction to record to maximize his payoff. The model's Nash equilibrium show that our scheme can generate sufficient fees under delay-insensitive applications, via raising the fee threshold and increasing the market competition. The numerical results show that our scheme may increase the social welfare for delay-sensitive applications. We further implement a blockchain protocol and deploy 114 nodes. The experiments show when users greedily update their transaction fees based on their payoffs, the average fees converge to the analytical results.” | | | | | |
| Guidelines:   1. Brief introduction 2. Significance/motivation 3. Expected contribution/outcome 4. Research methodology 5. Research plan 6. I decide to publish this paper in the conference INFOCOM 2021 this year corporate with Dr. Yunshu Liu who is now studying in CUHK Shatian Campus. Yunshu Liu will be the first author of this paper while I will be the second author together with Zhixuan Fang, Man Hon Cheung, Prof. Wei Cai, and Prof. Jianwei Huang as the third, fourth, fifth, and sixth author. Briefly, we design a special yet effective mechanism in which the user in the Bitcoin Block Chain system has to optimize their transaction fee and transaction size ratio to get the transaction recorded by the miners (operate nodes) in the system in time. 7. The booming of blockchain systems leads to significant storage cost for miners, which is difficult to cover by users' transaction fees. Such a phenomenon may jeopardize the blockchain security in the long-run. In this paper, we propose an incentive mechanism to alleviate this insufficient-fee problem in delay-insensitive blockchain applications by adjusting the transaction time limit, which is an easily implementable modification to the blockchain protocol. 8. The model's Nash equilibrium show that our scheme can generate sufficient fees under delay-insensitive applications, via raising the fee threshold and increasing the market competition. Our model will help to alleviate the current situation in which storage is far from optimized in the Bitcoin Block Chain system. 9. We implement a blockchain protocol as well as experiment study in which deploy 114 nodes on the cloud. The experiments show when users greedily update their transaction fees based on their payoffs, the average fees converge to the analytical results. 10. We will model the interactions among the protocol designer, users, and miners as a three-stage decision process. In Stage I, the protocol designer optimizes the time limit to maximize the social welfare. In Stage II, each user adjusts his transaction generation probability and transaction fee to maximize his payoff. In Stage III, each miner selects a transaction to record to maximize his payoff. The numerical results show that our scheme may increase the social welfare for delay-sensitive applications. | | | | | |
| 项目开始日期  Project Start Date  yyyy/mm/dd | 2020.09 | | 项目结束日期  Project End Date  yyyy/mm/dd | 2020.12 | |
| 预期成果 | | | | |
| Expected Output (e.g. conference presentations, journal papers, etc.) | | | | |
| This paper will be possibly published on INFOCOM 2021. Our research team has already submitted the paper to the conference. Also, the incentive mechanism we designed in the paper will possibly | | | | |

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| 个人陈述 |
| PERSONAL STATEMENT |
| As a student major in Financial Engineering, technologies related to Block Chain are highly correlated with my major study in the undergraduate period. That is why I choose Block Chain to be my research field. |

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| 获奖情况（由最近日期起） | | |
| SCHOLARSHIPS AND OTHER AWARDS RECEIVED WHILE AT UNIVERSITY (Start with most recent) | | |
| 奖励名称 | 奖励描述 | 获奖时间 |
| Name of Award | Brief description and value of the award | Period held: |
| 励耘奖学金 | 入学奖学金 | 2019.09 |
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| 导师评鉴 | | |
| SUPERVISOR(S)’ COMMENTS | | |
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| 导师签名  SUPERVISOR’S SIGNATURE   * I hereby certify the authenticity and originality of the applicant’s proposal. | | |
| 导师姓名和学院  Name and School of Supervisor(s)  Wei Cai | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | 2020.9.5 |
|  | Signature of Supervisor | Date |

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| 申请人签名  APPLICANT’S SIGNATURE | | |
| * I hereby agree to abide by URA’s policies and procedures governing the Undergraduate Research Awards. | | |
| 姓名  Name  Shulin Ke | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | 2020.9.5 |
|  | Signature of Applicant | Date |

\*please submit the application form with all supporting documents to [*ura@cuhk.edu.cn*](mailto:ura@cuhk.edu.cn) before the application deadline.