# Lei Ding

# Publications

### Paper abstract & Skeleton

**Title:** Deep research on JXME's MIDP protocol and video-sharing framework

**Authors:** Ding Lei, Li Zhisu, Peng Jian, Shi Xianlin, Wu Wei, Jian Xiaoyu

**Abstract**:

In this paper, the process of implementing the JXME's MIDP protocol and HTTP connection between relay proxy and mobile peer are introduced. In the meanwhile, the encapsulation of Byte Streams on the end of mobile is analyzed. Fixing with several serious programming bugs that severely impact the stability and scalability of MIDP framework, one basic programming framework for sharing resources among mobile peers is proposed.

**Key words**:

JXME(J2ME JXTA client), relay proxy, mobile peer, encapsulation, framework

**Skeleton**:

1. Introduction
2. JXTA-JXME model
3. JXME's MIDP protocol
4. Resource sharing framework based on JXME
5. Experiments
6. Conclusion

**Title:** Protein-ligand binding affinity prediction using Deep Learning

**Authors:** Abena AChiaa Atwereboannah, Wu Weiping, Ding Lei, Sophyanbi B. Yussif, Edwin Tenagyei

**Abstract**:

Protein-ligand prediction plays a key role in drug discovery. Nevertheless, many algorithms are over reliant on 3D structure representations of proteins and ligands which are often rare. Techniques that can leverage the sequence-level representations of proteins and ligands are thus required to predict binding affinity and facilitate the drug discovery process. We have proposed a deep learning model with an attention mechanism to predict protein-ligand binding affinity. Our model is able to make comparable achievements with state-of-the-art deep learning models used for protein-ligand binding affinity prediction.

**Key words**:

Deep learning; Protein–ligand binding affinity; Self-attention; Drug discovery

**Skeleton**:

1. Introduction
2. Related work
3. Materials and methods
4. Evaluation metrics
5. Training, results and evaluation
6. Conclusion

### Patent summary

**Title:** Rating of city road segments for taxi hailing based on HANA technology

**Authors:** Daihui Zhu, Ke Wang, Lei Ding, Qiwei Zhang, Ye Jin, Yinling Ni

**Patent info.**: US Application NO. 13/934,706 | Patent ID 81495268 | Patent Ref 120542US01, China Application NO. 20130269463.3 | Patent ID 82826027 | Patent Ref 120542CN01

**Summary**:

How to discover better locations for taxi requesters to hail their wanted taxis given historical data of taxis, start-destination pairs, time and season parameters of hailing events is always a general problem in most of big cities in China. Even if sometime just 100 meters away from their current location passengers can easily pick up a taxi, they still seem blind to their best options. Moreover, this issue is also dependent on seasons, week days as well as specific day time, which casts challenge to most citizens and visitors. In this patent, We resort to massive taxi trace data (tens of millions per day) from taxi companies in a big Chinese city and personal location data from mobile app to help citizens and visitors find the best nearby locations to hail an open taxi given all factors mentioned before. The location calculation has been done on SAP HANA in-memory calculation platform, which provide an instant insight to discover the best nearby road segments that taxi candidates are located at via HANA's high performance data mining capability.

**Innovations**:

1. The calculation is not only based on historical taxi location data, but also integrates with real-time location data collected from mobile app. This can help improve accuracy of calculation results iteratively

2. The calculation is multi-dimensional which contains various measures, such as heading of taxis, pickups, taxi vacancy and ratio of demand and supply etc.

3. The calculation has been executed on SAP HANA platform, which speeds up the whole process of data retrieval and analysis with less disk IO due to optimized data indexes

**Title:** Simulator of bundle clicking for validating Bandit strategies in A/B testing

**Authors:** Lei Ding, Yangyang Chen

**Patent info.:** US Application NO. 17/547,637 | Patent ID 83839171 | Patent Ref 210412US01

**Summary**:

SAP upscale has delivered multiple client channels to allow customers to interact with backend services, such as iOS, Android applications and web applications. As an AI-enabled backend system, many system features have to be verified through A/B testing in order to understand if those features will really improve sales. However, an obvious drawback is that merchants may suffer from losing potential customers, if trials of new product fail to fulfill customers' satisfaction in a relatively longer time duration. Therefore, whether we can estimate our product features' effectiveness in the minimal interaction time with customers plays a crucial role for business success, especially at the phrase of introducing new products with unseen features. In this patent, we design and implement a powerful simulator which can mimic customers' interaction behaviors with backend system and evaluate the effectiveness of Bandit strategies. This simulator successfully addresses the issue of how to generate product bundles given customers' interest in a more effective way, by analyzing key customers' behaviors, adjusting data generation distribution and resorting to a natural interest-decay mechanism.

**Innovations**:

1. Achieve a great improvement for effectiveness validation of Bandit strategies used in SAP upscale: less customer interaction time, more accurate tracking for convergence time point, full information about the whole interaction lifecycle

2. Imitate customer interests in a more natural way by introducing a natural decay model and allowing to import metadata of customer interests

3. Have a clear tracking mechanism for profit/customer behavior in the simulating process, which facilitates us to better understand customer behaviors

4. Provide flexibilities by introducing product features and more sophisticated probabilistic models used to simulate and predict customers' interest on products

**Title:** Reinforcement Learning Model for product recommendation considering balance between product profit and customer interests

**Authors:** Lei Ding, Yangyang Chen

**Patent info.:** US Application NO. 17/556,238 | Patent ID 83848635 | Patent Ref 210416US01

**Summary**:

For SAP Upscale, how to reach an equilibrium between gaining product profit for merchants and satisfying customer personal interest is a demanding requirement. A more challenging part is that those two factors are usually entangled together. Another challenge is that factors that determine how to suggest products to end customer are more likely to vary as time goes by. Furthermore, there almost

exists no solution to integrate frequently-updating algorithm models with the product platform implemented by different programming languages.

Fortunately, after technical investigation & algorithm optimization continuously, we successfully addressed these three issues. Here we design and implement a powerful algorithm based on Reinforcement Learning Model (RL), which reach a dynamic equilibrium of merchant profit and customer interests as well as support dynamic feature introduction. In the end, this algorithm is capable of automatically combining profit purpose and other more sophisticated factors, like customer interest, inventory, etc., achieving a state-of-art performance. Additionally, a language-neutral framework based on Google Tensorflow has been designed to solve how to make algorithm model smoothly integrate with the product system. By utilizing those two deliveries, we not only settle down the issues mentioned above, but also provide a new way for our scientific research and further guarantee delivery efficiency.

**Innovations**:

1. Figure out the balance with multiple factors that are crucial in product recommendation using RL models and provide qualitive measures to evaluate how such goal has been reached in system

2. Provide the flexibility of incorporating with more recommendation factors: almost a zero-code adjustment if incorporating with more factors or adjusting priority of those factors

3. Have a better generalization capacity: as both LFA and DDPG that we used are standard deep reinforcement learning algorithms, they are easily integrated with other similar scenarios, such as searching items in inventory, production material preparation under the minimal cost

4. Facilitate research and development work: by leveraging the language-neutral framework based on Google Tensorflow, scientists can focus on algorithm design and developers can concentrate on how to prepare data in the pre-defined format. More importantly, it can also be applied for other LoBs (Line of businesses) under distinct scenarios without extra efforts