

《智慧农业发展战略研究》专题快报

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中国工程科技知识中心农业分中心

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【动态资讯】

1. 湖南云上“农事智囊团”化身主播传新技

【农民日报】冬季正是农机入库维修保养，农机手培训充电的好时节，虽然新冠疫情阻断了“面对面”的农业科技指导，但为了使农业科技服务最后一公里在特殊时期能够畅通无阻，湖南农业领域的专家教授们依托互联网，借助各类科技服务平台，积极探索农业技术推广和社会服务新模式，组成云上“农事智囊团”，进行科技指导、政策咨询和产业发展服务，“屏对屏”隔空在线把脉问诊农事，为农民朋友提供各种农事技术指导。

链接:

<http://agri.ckcest.cn/file1/M00/0F/E9/Csgk0GGbOqSAAC0xACLwosMnBHc181.pdf>

2. 数字技术助力储粮设备智慧化

【农民日报】近日，中共中央办公厅、国务院办公厅印发了《粮食节约行动方案》，从加强粮食储存环节减损、加强粮食运输环节减损保障、加快推进粮食加工环节节粮减损、大力推进节粮减损科技创新等八个方面提出了明确要求，推动粮食全产业链各环节节约减损取得实效。科技创新在推动全链条减损中起到重要作用，加快智能化粮库科技投入，大力推广绿色科技储粮，成为实现粮食减损、维护粮食安全的重要屏障。这其中既有对基础设施建设的减损要求，也有对软件技术的减损要求。可以考虑充分运用云计算、物联网、人工智能等新一代信息技术，加大绿色科技储粮技术和数字化技术的融合，在数字粮仓建设、粮食的静态监管等方面，借助虚拟现实、云图模拟等技术，实现精准感知、风险预警和智能调节，这些都能够有效发挥科技储粮的效能，并保障仓储环节的节粮减损和优粮优储目标。

链接:

<http://agri.ckcest.cn/file1/M00/03/17/Csgk0WGbOt6AFu6iACLwosMnBHc527.pdf>

3. 天敌治虫 番茄潜叶蛾被寄生机制揭示

【新京报】近日，记者从中国农科院获悉，科研人员首次从生物防治角度，对新发重大恶性入侵害虫番茄潜叶蛾进行了研究，揭示出其寄主选择行为机制，这一成果促进了对潜叶类害虫-寄生蜂相互作用的认识。相关研究成果在线发表在《普通昆虫学》上。这一研究结果，为利用该寄生蜂防治番茄潜叶蛾技术体系的研发打下了理论基础。该研究得到了国家自然科学基金和国家重点研发计划项目的资助。

链接:

<http://agri.ckcest.cn/file1/M00/03/17/Csgk0WGbOqeAPr26AAsAQFWABJI002.pdf>

4. 3500亩试验田走出“科技范儿”

【中国农网】在黑龙江省创业农场，中国农业大学水稻智慧管理无人农场建设项目学生郝雅楠，正在开展多源遥感水稻营养诊断试验，采集地面样品，通过农场的“智慧管理系统”，进行数据分析。如今，建三江这片黑土地成了全国机械化程度最高、最重要的商品粮基地之一。但是，建三江水稻生产面临着秸秆还田、黑土退化等引起的土壤-植物-环境矛盾问题，以及适应规模化水稻生产体系的数字化智能机械化发展需求的双重挑战。范明生说：“未来在农艺技术不断优化基础上，仍待探索实现数字化、智慧化水稻绿色生产。”未来，中国农业大学资环学院将继续围绕黑土地保护、寒地稻作绿色生产、“大数据驱动智慧化决策-智能装备精准作业”的水稻智慧数字农场等领域开展产学研协同创新，支撑区域发展和引领国家农业的绿色数字转型。

链接:

<http://agri.ckcest.cn/file1/M00/03/17/Csgk0WGbOwiAToD6AA3Ez4TxQz4810.pdf>

5. 我科学家找到作物光合产物运输“高速路”

【人民政协报】近日，中国农业科学院生物技术研究所作物高光效功能基因组创新团队发现调控光合产物蔗糖运转效率的关键基因SEM1，为培育高光效作物提供了新的基因资源。研究有望在光合作用源器官叶片与库器官种子之间搭建一条快速转运的“高速路”，加快蔗糖的转运，有效提高光合效率及作物产量。蔗糖是植物主要的光合产物，在源器官叶片中合成并经维管组织向库器官转运，经水解用于合成淀粉、蛋白质等有机物。因此，蔗糖转运对于作物生长发育和产量形成至关重要。然而，调节蔗糖转运的关键步骤仍有待阐明。为此，团队进行了大规模水稻突变体筛选，在6万多一份材料中获得了两个叶片蔗糖过量积累的等位突变体，其表现为生长发育受阻、光合效率下降。研究发现，sem1基因编码一个主要在维管韧皮部细胞表达的胍胍质合成酶，其功能缺失将

导致维管细胞减少，蔗糖从源器官到库器官的运输受阻，滞留的蔗糖在叶绿体中合成淀粉并过度积累，从而负反馈调节光合作用。

链接:

http://agri.ckcest.cn/file1/M00/0F/E9/Csgk0GGbOjaANQqEAAN3Mya8k_o392.pdf

6. 桐城孔城镇：从“传统农耕”到“现代生态农业”的华丽转身

【新华网】近年来，桐城市孔城镇南口村以发展观光农业、体验农业、创意农业等新业态作为村集体经济的发展主线，农业生产融入“闲、养、乐、学”等多种功能，推动农业与旅游休闲，教育文化与健康养生等深度融合，“十年磨一剑”，农旅产业初具规模。南口村党总支“十年磨一剑”，成功打造了初具规模的红豆杉基地与“三生园”，建成现代农业样板，带动了生态孔城的建设与乡村旅游，也促进了村集体经济的迅猛发展，南口村迎来了从“传统农耕”到“现代生态农业”的华丽转身。

链接:

http://agri.ckcest.cn/file1/M00/03/17/Csgk0WGbO0yABJ_OABTXxWisuUE576.pdf

7. H5N8病毒肆虐全球，我国家禽为何“独善其身”

【科技日报】中国农业科学院哈尔滨兽医研究所陈化兰院士团队最新研究发现，对家禽业杀伤力巨大的H5N8亚型禽流感病毒，虽然于去年底今年初通过天鹅传入我国境内，但并未引起我国家禽禽流感疫情暴发。该团队在2020年9月至2021年6月间采集并分析了41172份家禽拭子样品和317份野鸟样品，分离到36株H5N8病毒，其中22株来自野鸟，14株来自鸭和鹅。研究发现，这些病毒对鸡高度致死，对鸭温和，对小鼠致病力因毒株而异。更重要的是，我国家禽养殖场中常规免疫的鸡和鸭可完全抵御H5N8病毒攻击，由此解释了H5N8病毒肆虐全球，为何中国家禽可以“独善其身”。鉴于在野鸟中广泛存在的H5N8病毒会对家禽和公共卫生构成持续威胁，本研究强烈呼吁高风险国家对家禽进行H5疫苗免疫，有效阻断病毒由野鸟传入家禽，保护人类生命健康。

链接:

<http://agri.ckcest.cn/file1/M00/0F/E9/Csgk0GGbOnWAK34iAAO5FN1kbDY665.pdf>

8. 北大荒农服探索农业现代化发展新模式

【中国网】黑龙江拥有两亿多亩耕地，是名符其实的祖国大粮仓，这片土地上的种粮人在谈论农业种植水平时最常说的一句话是：北大荒水平。北大荒集团的种植水平在当地农民心目中就是最高水平，就是农业现代化。今年，黑龙江省委全会提出的推进农业农村现代化实现新突破的目标之一就是：到2025年底，建成农业强省，垦区和具备条件

的市县率先基本实现农业现代化,全省农业农村现代化实现新突破。北大荒集团在推动地区农业向专业化、标准化、社会化转型上持续发力,促进乡村振兴,形成了可复制、可推广的“北大荒模式”。

链接:

<http://agri.ckcest.cn/file1/M00/0F/E9/Csgk0GGbOvCAGhKWAAJq1eDX2U458.pdf>

【文献速递】

1. 气候变化下基于GIS的农田恶性杂草旱雀麦在中国的分布与发展趋势

文献源: 干旱地区农业研究,2021-11-15

摘要: 为确定旱雀麦在我国的空间分布及其对气候变化的响应,以期进一步开展生态防控,本研究利用旱雀麦在中国的地理分布数据,结合当前气候数据和未来气候变化情景(RCP8.5情景下2050s,2070s),建立最大熵模型(MaxEnt模型),确定影响旱雀麦分布的主导环境因子。应用地理信息系统(GIS)对中国地区旱雀麦的适生区进行划分,以ROC曲线作为模拟的准确性评价指标。结果表明,MaxEnt模型模拟效果极好(AUC=0.965);当前气候条件下,旱雀麦适生面积为 2.5534×10^6 km²,主要集中分布于青海省东北部、甘肃省与青海省接壤的地区、四川省的西北部,以及新疆的西北部;其中影响旱雀麦分布的主要环境因子为海拔、bio12(年降水量)、bio9(最干季度平均温度)和bio15(降水量季变异系数),其贡献率分别为45.0%、17.5%、9.7%、9.7%,累计贡献率达81.9%;在RCP8.5情景下,未来2个时期,旱雀麦潜在高适生区分布面积与当前相比增加了12.2%~23.3%,但RCP8.5情景下2070s较RCP8.5情景下2050s旱雀麦的潜在高度适生区分布面积减少了8.9%。综上所述,气候变化情景下旱雀麦的潜在分布面积呈现出扩大趋势,且RCP8.5情景下2070s较RCP8.5情景下2050s的适生区分布面积有缩减趋势。

链接:

<http://agri.ckcest.cn/file1/M00/03/17/Csgk0WGbO9GAYReIAAckTf8wbN0135.pdf>

2. 利用无人机激光雷达提取玉米叶面积密度

文献源: 武汉大学学报(信息科学版),2021-11-05

摘要: 叶面积密度可以表征冠层内部叶面积的垂直分布,是作物生长发育、营养诊断和育种研究的重要结构参数。激光雷达通过发射多脉冲和接收多回波信号可以探测到作物冠层内部信息。首先基于无人机激光雷达获取60个小区多航线的玉米点云数据,采用基于接触频率的体素法对叶面积密度进行估算,再对多个体素大小进行分析得到最优体素大小(0.2 m);其次对各航线以及航线叠加效果进行对比,得到无人机激光雷达获取点云数据的最优激光脉冲入射角(-30°~52°);然后结合玉米叶倾角和激光脉冲入射角对

叶面积密度估算模型进行校正,从而提高叶面积密度估算精度;最后通过对不同种植密度和不同品种的玉米叶面积密度分布进行分析,得到不同品种玉米的发育快慢、株型特点以及最合理的种植密度。以上结果可为基于无人机激光雷达数据估算叶面积密度提供指导,并为玉米育种和科学管理提供参考。

链接:

<http://agri.ckcest.cn/file1/M00/03/17/Csgk0WGbO-2AZWHbAByKLOZNDDI401.pdf>

3. Fine-tuning shoot meristem size to feed the world

文献源: ScienceDirect,2021-11-04

摘要: In order to maintain food security for the world's growing population, crop yields need to be significantly improved. Domestication and crop improvement involve modification of traits such as fruit size and seed number to optimize productivity. Although these traits are selected at the mature stage, they are determined during the development of shoot meristem, a tissue that forms successive meristems and reproductive organs that make edible fruits or seeds. Therefore, the architecture of reproductive organs and yield-related traits are determined during the maturation of shoot meristem. Here, we highlight recent progress in understanding how shoot meristem size affects yield-related traits and outline the strategies to fine-tune meristem regulatory genes to meet the demands of a growing population and promote sustainable agriculture.

链接:

<http://agri.ckcest.cn/file1/M00/0F/E9/Csgk0GGbO7WAGSxDABf92IPGhds973.pdf>

4. 基于CNKI数据库的国内草原生态补偿研究的知识图谱分析

文献源: 中国农业资源与区划,2021-11-03

摘要: 自草原生态补偿政策实施后,为了深入了解草原生态补偿相关研究的现状及发展趋势,客观反映相关机构、文献、作者的科研动向和影响力,通过分析得出现有研究的不足并提出建议。文章通过CiteSpace软件对CNKI数据库搜索到关于草原生态补偿的相关文献进行可视化分析。表明:研究领域内发文量总体呈现先增长后下降趋势,2016年达到发文量峰值。作者靳乐山、胡振通、孔德帅发文量较多,杨光梅、陈佐忠、李玉新等作者发表的文献对该领域学者有着很好的指导作用,发文量最多的机构为新疆维吾尔自治区草原总站,但作者、机构之间中心性较低,还需加强合作。综合分析热点和前沿,主题词较少,研究范围较局限。应在现有的研究基础上结合实践,加强理论研究,完善区域的草原生态补偿治理办法、补偿标准、补偿方式、建立草原生态补偿机制与制度体

系等方面的研究,拓展研究范围和深度,各地政府根据地区差异性对当地草原生态补偿政策相关进行探索完善,创新研究方法,弥补现有研究的不足,为建立符合我国国情,具有我国特色的草原生态保护补偿制度体系提供参考。

链接:

<http://agri.ckcest.cn/file1/M00/0F/E9/Csgk0GGbO5CANNqAABJE5niCD50003.pdf>

5. 区块链在无人作业农机协同控制中的应用研究

文献源: 农机化研究,2021-10-28

摘要: 在农业生产过程中,多无人机联合作业可以有效地提高农业生产的自动化水平及作业效率。无人机协同控制时,为了保证通信的稳定性,引入了区块链技术,通过去中心化和不可篡改性,有效保证了通信系统的正常运行。模拟无人农机的作业环境,以多农机协同PID控制为例,对基于区块链的农机协同控制系统进行了测试,结果表明:每台农机的PID控制器都可以发挥较好的控制作用,保证了控制系统的稳定性。

链接:

<http://agri.ckcest.cn/file1/M00/0F/E9/Csgk0GGbO3KAC9fWACPYhQJ99TE610.pdf>

6. The crucial role of lysine in the hepatic metabolism of growing Holstein dairy heifers as revealed by LC-MS-based untargeted metabolomics

文献源: ScienceDirect,2021-10-19

摘要: The objective of this experiment was to evaluate the effect of supplementing rumen-protected Lys based on a Lys-deficient diet on liver metabolism in growing Holstein heifers. The experiment was conducted for 3 months with 36 Holstein heifers (initial body weight: 200 ± 9.0 kg; 7-month-old). Heifers were randomly assigned to 2 diets based on corn, soybean meal, alfalfa hay, and wheat bran: control, Lysdeficient diet (LD; 0.66% Lys in diet), and Lys-adequate diet (LA; 1.00% Lys in diet). The results showed no difference in growth performance between the 2 groups ($P > 0.05$). However, there was a clear trend of increasing feed conversion rate with Lys supplementation ($0.05 < P < 0.01$). The serum urea nitrogen concentration was significantly decreased, and the aspartate aminotransferase-to-alanine aminotransferase ratio was significantly decreased by Lys supplementation ($P < 0.05$). Moreover, growing heifers fed a Lys-adequate diet had lower levels of urine nitrogen excretion and higher levels of the biological value of nitrogen ($P < 0.05$). Metabolomic analysis revealed that 5 types of phosphatidylcholine and 3 types of ceramide were significantly increased and enriched in sphingolipid metabolism and

glycerophospholipid metabolism ($P < 0.05$). His, Leu, and Asp levels were significantly decreased in the liver following Lys supplementation ($P < 0.05$). In conclusion, Lys supplementation may promote the synthesis of body tissue proteins, as evidenced by significantly decreased amino acids in the liver and urine N excretion, it also improves hepatic lipid metabolism by providing lipoprotein precursors.

链接:

<http://agri.ckcest.cn/file1/M00/03/17/Csgk0WGbPCyAIPQ-ABKOWMn5b64953.pdf>

7. Proteomics Analysis Reveals Altered Nutrients in the Whey Proteins of Dairy Cow Milk with Different Thermal Treatments

文献源: MDPI,2021-07-30

摘要: Thermal treatments of milk induce changes in the properties of milk whey proteins. The aim of this study was to investigate the specific changes related to nutrients in the whey proteins of dairy cow milk after pasteurization at 85 °C for 15 s or ultra-high temperature (UHT) at 135 °C for 15 s. A total of 223 whey proteins were confidently identified and quantified by TMT-based global discovery proteomics in this study. We found that UHT thermal treatment resulted in an increased abundance of 17 proteins, which appeared to show heat insensitivity. In contrast, 15 heat-sensitive proteins were decreased in abundance after UHT thermal treatment. Some of the heat-sensitive proteins were connected with the biological immune functionality, suggesting that UHT thermal treatment results in a partial loss of immune function in the whey proteins of dairy cow milk. The information reported here will considerably expand our knowledge about the degree of heat sensitivity in the whey proteins of dairy cow milk in response to different thermal treatments and offer a knowledge-based reference to aid in choosing dairy products. It is worth noting that the whey proteins (lactoperoxidase and lactoperoxidase) in milk that were significantly decreased by high heat treatment in a previous study (142 °C) showed no significant difference in the present study (135 °C). These results may imply that an appropriately reduced heating intensity of UHT retains the immunoactive proteins to the maximum extent possible.

链接:

<http://agri.ckcest.cn/file1/M00/0F/E9/Csgk0GGbO-qAKqzHABJzpitGyhk803.pdf>

【会议论文】

1. Infection Segmentation of Leaves Using Deep Learning techniques to enhance crop productivity in smart agriculture

发布源: IEEE

发布时间: 2021-11-18

摘要: Agriculture has been playing a vital role in human existence. Several new techniques have been invented and discovered to increase crop productivity. Along with the increase in crop production, the problems related to disease/infection in the crop have also increased. The farmer may sometimes have low or no knowledge about the infection, or he may be in a situation where he couldn't be able to identify the small traces of the infection that has been induced on the leaves. Infection classification, detection, and segmentation play a vital role in helping the farmers identify the infection at its budding stage and take the required remedies for it. The previous approaches made in this context were based on classification and detection only. These approaches have certain limitations, and they did not specify the infection in its exact proportion. To overcome the limitations of previous approaches, a segmentation approach can be used to accurately segment all infected spots of the infection on the leaves in their exact shape. Instance segmentation of the leaf disease helps to solve the overlapping bounding boxes problem as it segments the infected spots with different colors showing the difference. The advantage of segmentation further covers the classification of the infection type, localizing with the help of a bounding box, and essentially segment the infected areas using colored masks. Mask RCNN, is the instance segmentation algorithm that can be used to solve the aforementioned problem, by processing through several layers of convolutional neural networks. Instance Segmentation is difficult because it necessitates both accurate detections of all objects in an image and exact segmentation of each instance. This helps the farmer identify the infection on the leaf without prior knowledge about the type of infection that has affected the crop to take the required remedy to stop the infection. Moreover, this approach eliminates the burden of manual intervention in identifying the infection.

链接:

<http://agri.ckcest.cn/file1/M00/03/17/Csgk0WGbO2eAc1gBAAs62RnjrwA962.pdf>

2. Towards Sustainable Food Security: An Interdisciplinary Approach

发布源: IEEE

发布时间: 2021-11-18

摘要： As urbanization moves towards globalization in the next century, the evolution of smart city technologies has also brought new approaches to traditional public wellbeing problems such as food accessibility at both global and local scales. Technology implemented using the Internet of Things and data analytics offers unique advantages and challenges to address issues related to food access. In addition, interdisciplinary efforts are necessary to effectively utilize emerging technologies to address the issue of food insecurity while considering the underlying complex social, economic, and environmental dimensions. In this paper, we discuss the multi-dimensional nature of the food accessibility problem in U.S. metropolitan regions and explore the connection between the fields of engineering, social science, agriculture, education, and life sciences, with respect to their collective impact on addressing the food accessibility problem. We also present our team's ongoing efforts to identify and address food insecurity problems in Richmond, Virginia through interdisciplinary research.

链接:

<http://agri.ckcest.cn/file1/M00/0F/E9/Csgk0GGbOwuAJf6FABM0rSeSJUU083.pdf>

3. A Novel Model for Optimization of Resource Utilization in Smart Agriculture System Using IoT (SMAIoT)

发布源: IEEE

发布时间: 2021-11-16

摘要： Many Countries have rich resources of land, rivers, groundwater, environment and fertilizers availability. Agriculture is the main source of income for several country's people. Since the last few decades, there are few resource shortages like groundwater, river water. People are unaware of proper utilization of available valuable resources, which leads to use more resources for less crop production. One of the solutions of this problem is to design and implement an IoT based smart framework for agriculture. In this paper, we have proposed a smart agriculture framework to monitor different types of low cost IoT sensors-devices, which collects data from soil, air, water, insects and make appropriate decisions based on analysis of sensors data. Novel contribution of our proposed approach is to automate tasks of irrigation, fertigation, pest detection, pesticide spray in a scientific way with minimal farmer's intervention in one framework. This paper contains detailed implementation steps and result of smart irrigation module of our framework.

链接:

<http://agri.ckcest.cn/file1/M00/0F/E9/Csgk0GGbO1WAWg4LABV61HXU60s576.pdf>

4. LiveCare: An IoT based Healthcare Framework for Livestocks in Smart Agriculture

发布源: IEEE

发布时间: 2021-11-16

摘要: In the field of smart agriculture health monitoring of livestock is an important field of research. Maintaining the good health of cows is very much essential for the steady growth of milk production. Unfortunately, in a large dairy cow farm, day-to-day monitoring of the health status of individual cows is a complex and time-consuming activity. This paper proposed LiveCare, an IoT-based framework that automatically monitors the health of cows in a large cow farm. It tracks the cow's behavioral changes on a daily basis. This paper also proposed the Cow Disease Prediction (CDP) algorithm, which is an unsupervised multi-class classifier that serves as the LiveCare framework's central component. The CDP algorithm can predict several cow diseases by analyzing the cows' behavioral changes. In this framework, we have also tabulated a few common cow diseases, their measurable symptoms, and the various sensors used to record them. We compared the efficiency of the proposed CDP algorithm to that of other machine learning algorithms.

链接:

http://agri.ckcest.cn/file1/M00/0F/E9/Csgk0GGbOyqAbLJrAFN8QlvD_WY949.pdf

5. Smart Irrigation System using Internet of Things (IoT) and Machine Learning

发布源: IEEE

发布时间: 2021-11-15

摘要: Despite the world being in 21 st century most of the developing and under-developed nation use traditional method for farming we requires tremendous energy and hectic schedule from a small scale farmer with a very measly return in terms of profit moreover the water wastage and continuous monitoring required to keep check in plants condition is just unjustified but with 58% of population having agriculture as primary income source most of the Indian farmers having extremely low income it seems impossible for them to hop over costly machineries. But now with the cost-effective processors out there in the market can provide a solution to all these issues faced by Indian farmers. With exponential progress of Internet of Things (IoT) devices in the market smart irrigation systems are becoming a new trend. This paper proposes design and theory of one such smart irrigation

system using NodeMCU to wirelessly operate a network of irrigation modules by irrigating the field when required by measuring the water content of soil and keep checking condition of plant using a camera this paper also provide insight of how to keep safe integrity of data which travels from NodeMCU to user smartphone using ciphering methods and by keeping proposed system reliable and cost effective.

链接:

<http://agri.ckcest.cn/file1/M00/03/17/Csgk0WGbO7GARc1eAAtr730Wyug484.pdf>

6. Integration of a UAV-LIDAR System for Remote Sensing of CO₂ concentrations in Smart Agriculture

发布源: IEEE

发布时间: 2021-11-15

摘要: Precision agriculture is reliant on making timely, effective measurements to optimize workflow and crop yield. Manual inspection techniques are time consuming and do not support a frequent and autonomous monitoring of the field. This paper examines an innovative application of using a bistatic LIDAR sensor integrated into a UAV to monitor in-field CO₂ concentrations. Measuring variations in atmospheric CO₂ concentrations in agriculture can be used to detect plant health through correlation of photosynthesis efficiency and used to determine soil quality. LIDAR systems can maintain highly accurate measurements, particularly of small changes in CO₂ concentrations, from substantial distances, making it ideal for remote UAV monitoring. Integration of such system into the UAV requires resolving mechanical, electrical, communication computing and control aspects, which are addressed in this paper through a feasibility study of the ground station tracking the system to steer the gimbal, on which the sensor is mounted. There is substantial interest in determining the appropriate UAV platform and consequently the hardware and software architecture and integration into the UAS.

链接:

http://agri.ckcest.cn/file1/M00/03/17/Csgk0WGbO4mAbz5UABty4e_7bSk521.pdf

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