

## 中国汽车 China Automobiles

### OpenAI 发布 AI 对话模型 ChatGPT，开启生成式 AI 商业化新机遇

OpenAI Releases Language Model ChatGPT, Opening New Opportunities for AIGC to Commercialize

观点聚焦 Investment Focus

股票名称	评级	目标价	市盈率 P/E	
			2022E	2023E
比亚迪	Outperform	309.80	56	38
长安汽车	Outperform	11.58	17	n.a.
赛力斯	Outperform	75.25	n.a.	707
伯特利	Outperform	31.25	n.a.	80
江淮汽车	Outperform	13.90	81	n.a.

(Please see APPENDIX 1 for English summary)

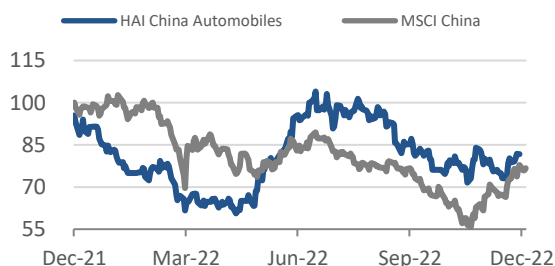
#### 事件

当地时间 11 月 30 日，美国人工智能公司 OpenAI 发布全新产品 ChatGPT，一款基于 GPT-3.5 的免费对话模型。公司 CEO Sam Altman 透露上线五天该模型的全球用户数量已突破百万。

**兼具理解力、创造力和记忆力，ChatGPT 对话模型“出圈”。**作为一款生成式人工智能模型，ChatGPT 的主要功能是与用户进行自然语言的交互，即与用户对话。据 OpenAI 官网介绍，ChatGPT 在与用户展开对话的过程中能够“回答后续问题，承认自己的错误，质疑不正确的前提，并拒绝不适当的请求”。相较苹果 Siri、微软小冰等 AI 服务，ChatGPT 最大的亮点之一在于它可以理解用户需求并创造内容、协助代码编写、能够针对用户的追问在后续对话中进行修正或补充。除了逻辑严密的创造能力之外，ChatGPT 具有记忆能力，在连续的对话中无需用户提供重复信息，其语言组织和表达能力也更接近人类水平，使对话更自然流畅。目前的 ChatGPT 局限性也较为明显，官网提示无法保证 ChatGPT 生成内容的准确性，此外部分创作内容或涉及版权问题。

**依赖大训练规模和强化学习算法，资本注血充沛。**ChatGPT 的研发公司 OpenAI 于 2015 年成立，2018 年发布生成式预训练 Transform 模型 GPT-1，随后于 2019 年和 2020 年分别优化推出 GPT-2 和 GPT-3。训练参数方面，GPT-3 由 GPT1 的 1.17 亿提升至 1,750 亿，公司通过提升训练语料的规模和质量实现 GPT 系列迭代，而 ChatGPT 即脱胎于 GPT-3.5，其训练参数规模较前代 GPT-3 又提升了一个数量级，功能更为强大。据悉，OpenAI 正在开发的 GPT-4 模型训练规模或达 100 万亿。算法模型方面，本次 OpenAI 引入的人工标注数据和 PPO 强化学习算法能够结合参数庞大的相关性模型与人类反馈，在与人类互动中通过反馈来强化学习。换言之，用户给予的反馈越多，ChatGPT 就会被“打磨”得越好，这也是 ChatGPT 采取免费试用策略的原因。资本和商业化方面，2019 年 7 月公司与微软达成合作协议，获得微软注资 10 亿美元同时向微软开放部分技术商业化权限。追求高技术的 OpenAI 不仅获得了雄厚的研发资本，与微软的合作也为之提供了商业化土壤。以 GPT-3 为例，微软官网宣布采用 GPT-3 模型赋能内部商业产品 Azure，服务企业用户。

**不破不立，AI 生成内容商业化前景广阔。**继 OpenAI 今年发布的人工智能图像生成器 DALL-E2 之后，ChatGPT 的推出再次拓展了生成式 AI 的商业化想象空间，也挑战了现有的商业逻辑。人工智能生成内容将刺激 AI 生成文本、图像、视频、代码等 C 端需求，也启发了诸如 GPT-3 在微软内部商业化落地服务企业的 B 端业务可能。



资料来源: Factset, HTI

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除此之外，类似 ChatGPT 的智能模型或会对搜索引擎产生一定替代。彭博指出 ChatGPT 用户可以在对话中直接得到想要了解的资讯，这一新型交互形态可能会冲击现有的搜索引擎广告业务。我们认为，ChatGPT 的发布为 AI 生成内容产业链提供了较多市场机遇，增加上下游需求，同时对现有商业规则的冲击也值得关注。

#### 风险提示

AI 生成内容法律法规不健全，模型开发不及预期，商业化进程不及预期等。

## ChatGPT 的训练步骤合称为 RLHF 技术

ChatGPT 训练过程主要分为三个步骤。

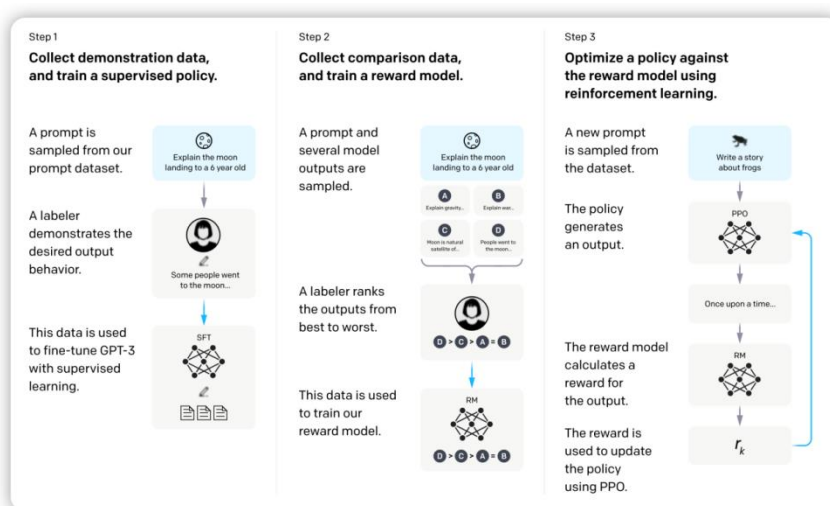
**第一步，使用有监督学习方式，基于 GPT3.5 微调训练一个初始模型**，训练数据约为 2w~3w 量级（此处为推测量级，我们根据兄弟模型 InstructGPT 的训练数据量级估算）。由标注师分别扮演用户和聊天机器人，产生人工精标的多轮对话数据。值得注意的是，在人类扮演聊天机器人时，会得到机器生成的一些建议来帮助人类撰写自己的回复，以此提高撰写标注效率。以上精标的训练数据虽然数据量不大，但质量和多样性很高，且来自真实世界数据。

**第二步，收集相同上文下，根据回复质量进行排序的数据**，即随机抽取一大批 Prompt，使用第一阶段微调模型，产生多个不同回答，之后标注人员对 k 个结果排序，形成多组训练数据对。之后使用 pairwise loss 来训练奖励模型，可以预测出标注者更喜欢哪个输出。"从比较中"学习可以给出相对精确的奖励值，这一步使得 ChatGPT 从命令驱动转向了意图驱动。另外，训练数据不需过多，维持在万量级即可。因为它不需要穷尽所有的问题，只要告诉模型人类的喜好，强化模型意图驱动的能力即可。

**第三步，使用 PPO 强化学习策略来微调第一阶段的模型**。核心思想是随机抽取新的 Prompt，用第二阶段的 Reward Model 给产生的回答打分。这个分数即回答的整体奖励（reward），进而将此奖励回传，由此产生的策略梯度可以更新 PPO 模型参数。整个过程迭代数次直到模型收敛。强化学习算法可以简单理解为通过调整模型参数，使模型得到最大的奖励，最大奖励意味着此时的回复最符合人工的选择取向。PPO 是 2017 年 OpenAI 提出的一种新型的强化学习策略优化的算法。它提出了新的目标函数，可以在多个训练步骤实现小批量的更新，特点在于实现简单、易于理解、性能稳定、能同时处理离散/连续动作空间问题、利于大规模训练。

以上三个步骤即 ChatGPT 的训练过程，合称为 Reinforcement Learning from Human Feedback（RLHF）技术。

图表 1 ChatGPT 的训练原理

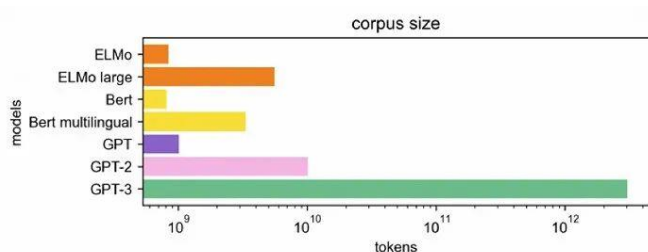


资料来源：OpenAI，海通国际

## ChatGPT 的成功基于 OpenAI 的技术积累

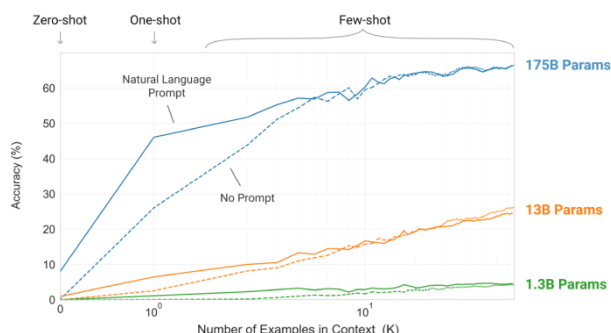
**ChatGPT 成功的关键原因：**1) 强大的基座模型能力 (InstructGPT)；2) 大参数语言模型 (GPT3.5)；3) 高质量的真实数据 (精标的多轮对话数据和比较排序数据)；4) 性能稳定的强化学习算法 (PPO 算法)

图表 2 不同大模型的数据集训练规模



资料来源：Medium，海通国际

图表 3 更大的模型能够更有效地利用上下文信息



资料来源：OpenAI，海通国际

**ChatGPT 能够实现当前的交互，离不开 OpenAI 在 AI 预训练大模型领域的积累。** OpenAI 最初提出的 GPT1，采取的是生成式预训练 Transform 模型（一种采用自注意力机制的深度学习模型），此后整个 GPT 系列都贯彻了这一谷歌 2017 年提出，经由 OpenAI 改造的伟大创新范式。简要说来，GPT1 的方法包含预训练和微调两个阶段，预训练遵循的是语言模型的目标，微调过程遵循的是文本生成任务的目的。

2019 年，OpenAI 继续提出 GPT-2，所适用的任务开始锁定在语言模型。GPT-2 拥有和 GPT1 一样的模型结构，但得益于更高的数据质量和更大的数据规模，GPT-2 有了惊人的生成能力，不过它在音乐和讲故事等专业领域的任务表现很不好。2020 年的 GPT-3 将 GPT 模型提升到全新的高度，其训练参数是 GPT-2 的 10 倍以上，技术路线上则去掉了初代 GPT 的微调步骤，直接输入自然语言当作指示，给 GPT 训练读过文字和句子后可接续问题的能力，同时包含了更为广泛的主题。

现在的 ChatGPT 则是由效果比 GPT-3 更强大的 GPT-3.5 系列模型提供支持，这些模型使用微软 Azure AI 超级计算基础设施上的文本和代码数据进行训练。具体来说，ChatGPT 在一个开源数据集上进行训练，训练参数也是前代 GPT3 的 10 倍以上，还多引入了两项功能：人工标注数据和强化学习，实现了在与人类互动时从反馈中强化学习。

也因此，我们得以看到一个强大的 ChatGPT：能理解人类不同指令的含义，会甄别高水准答案，能处理多元化的主题任务，既可以回答用户后续问题，也可以质疑错误问题和拒绝不适当的请求。当初，GPT-3 只能预测给定单词串后面的文字，而 ChatGPT 可以用更接近人类的思考方式参与用户的查询过程，可以根据上下文和语境，提供恰当的回答，并模拟多种人类情绪和语气，还改掉了 GPT-3 的回答中看似通顺，但脱离实际的毛病。

不仅如此，ChatGPT 能参与到更海量的话题中来，更好的进行连续对话，有上佳的模仿能力，具备一定程度的逻辑和常识，在学术圈和科技圈人士看来时常显得博学而专业，而这些都是 GPT-3 所无法达到的。尽管目前 ChatGPT 还存在很多语言模型中常见的局限性和不准确问题，但毋庸置疑的是，其在语言识别、判断和交互层面存在巨大优势。



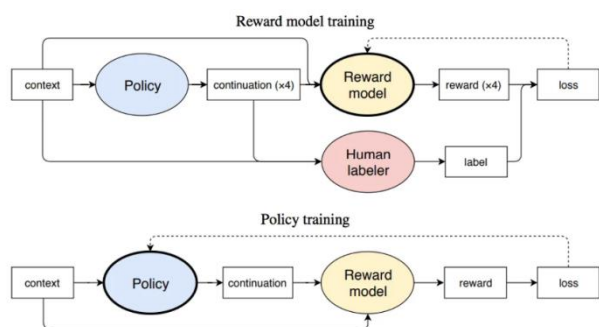
## ChatGPT 前代模型演变历程

在 2019 年 GPT2 出世后，OpenAI 就尝试结合 GPT-2 和强化学习。NeurIPS 2020 的 Learning to Summarize with Human Feedback 工作中写道，OpenAI 在摘要生成时，利用了从人类反馈中的强化学习来训练。可以从这篇工作的整体流程图中，看出三步走的核心思想：**收集反馈数据 -> 训练奖励模型 -> PPO 强化学习**。

RLHF 第一阶段是针对多个候选摘要人工排序；第二阶段是训练排序模型（依旧使用 GPT 模型）；第三阶段是利用 PPO 算法学习 Policy（在摘要任务上微调过的 GPT）。

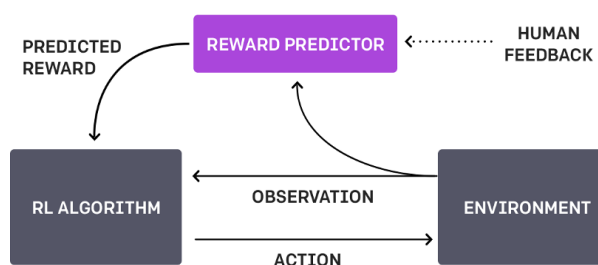
文中模型可以产生比 10 倍更大模型容量更好的摘要效果。但文中也同样指出，模型的成功部分归功于增大了奖励模型的规模。但这需要很大量级的计算资源，例如训练 6.7B 的强化学习模型需要 320 GPU-days 的成本。2020 年初的 OpenAI 的 Fine-Tuning GPT-2 from Human Preferences 可看出，它同样首先利用预训练模型来训练 reward 模型，进而使用 PPO 策略进行强化学习，已初见 ChatGPT 的雏形。

图表 4 2020 年 ChatGPT 的强化模型方案



资料来源：OpenAI，海通国际

图表 5 RLHF 框架：人类反馈+强化学习训练



资料来源：OpenAI，海通国际

ChatGPT 是站在 InstructGPT 以及上述理论的肩膀上完成的一项出色的工作，它们将 LLM（large language model）、PTM(pretrain language model)与 RL（reinforcement learning）出色结合证明这条方向可行。当然，这也是未来还将持续发展的 NLP 甚至通用智能体的方向。

## 未来 ChatGPT 商业化应用空间广阔

以上得到验证的核心技术结构可以应用的潜在领域：

1) 视频生成：图片生成+文本故事生成组合为视频；

2) 音乐生成（为已有视频生成配乐）；

3) 图片生成优化：为图片生成的模型提供更好的人类打分数据，用强化学习方式优化原有的图片生成效果（类似从 GPT3 到 ChatGPT 式的进步）；

4) 代码生成；

5) 文本生成优化：在某些专业领域提供更多的标注性数据，对领域内的文本生成效果进行强化，例如营销宣传等。

我们认为，未来在应用层面上，因为 ChatGPT 的出现和迭代，更多 AI+的机会将不断迸发，比如：

- 1) 诞生更专业的客服机器人和机器翻译；
- 2) 创业者朝着更垂直更专业化的 AI 进发（医疗、教育等）；
- 3) 出现新的创业机会，即 AI 基础设施的机会（模型运维，管理，训练等）。

## 风险提示

AI 生成内容法律法规不健全，模型开发不及预期，商业化进程不及预期等。

## APPENDIX 1

### Summary

#### Event

On November 30, local time, the American artificial intelligence company OpenAI released its new product ChatGPT, a free conversation model based on GPT-3.5. Sam Altman, CEO of the company, revealed that the number of global users of the model has exceeded one million within five days after its launch. Its intelligence and commercialization prospects have attracted enthusiastic attention.

#### Comment

**ChatGPT combines comprehension, creativity and memory.** ChatGPT's main function is to interact with users in natural language, i.e., to talk with them. According to the official website of OpenAI, ChatGPT can "answer followup questions, admit its mistakes, challenge incorrect premises, and reject inappropriate requests". Compared to AI services such as Apple's Siri and Microsoft's Cortana, ChatGPT can understand user needs and create content, including assisting in code writing, and can make corrections or supplements to subsequent conversations in response to users' follow-up questions. In addition to its logical creation capabilities, ChatGPT is able to memorize so that the users need not provide repetitive information in successive conversations. Its language organization and expression capabilities are closer to human level, making conversations more natural and fluent. Nevertheless, the limitations of the current ChatGPT are also obvious. The official website suggests that the accuracy of the content generated by ChatGPT cannot be guaranteed, and some of the created content may involve copyright issues.

**Relying on mega training scale, reinforcement learning algorithms and abundant capital injection.** Founded in 2015, OpenAI, the developer of ChatGPT, released the generative pre-training Transform model GPT-1 in 2018, followed by GPT-2 and GPT-3 in 2019 and 2020. The company realized the iteration of GPT series by improving the scale and quality of the training corpus. ChatGPT was born from GPT-3.5, whose training corpus scale has been further enlarged so its functions are more powerful than those of GPT-3. As for the algorithm model, the artificial labeled data and PPO reinforcement learning algorithm introduced by OpenAI can combine the correlation model with human feedback to achieve reinforcement learning in human interaction. Namely, the more feedback users give, the better ChatGPT will be "polished", which is to some extent the reason why ChatGPT adopts a free trial strategy. In terms of capital and commercialization, the company reached a cooperation agreement with Microsoft in July 2019, and received \$1bn from Microsoft while opening up some of its technology commercialization rights to Microsoft. OpenAI has not only acquired strong R&D capital, but Microsoft has also provided the ground for commercialization. Take GPT-3 as an example, Microsoft announced on its official website that it has adopted GPT-3 model to empower its internal commercial platform Azure which serves enterprise users.

**AI-generated content has a bright future for commercialization.** Following the AI image generator DALL-E2 released by OpenAI this year, the proposal of ChatGPT once again expands the commercial imagination of generative AI and challenges some existing business logic. On one hand, AI generated content is expected to stimulate the 2C demand of AI generated text, images, videos, codes, etc., and also 2B opportunities such as GPT-3 commercialized within Microsoft to serve enterprises. On the other hand, AI models like ChatGPT may play as alternative to search engines. Bloomberg pointed out that ChatGPT users can get the information they want directly in the conversation, so this new interaction form may influence the existing search engine advertising business. We believe that the release of ChatGPT will provide more market opportunities for the AI generated content industry chain, increasing upstream and downstream demand, and its impact on existing businesses is also worth paying attention to.

#### Risks

The laws and regulations of AI generated content are not established as expected, AI model R&D is not as expected, commercialization is not as expected, etc.



## 附录 APPENDIX

### 重要信息披露

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**优于大市**, 未来 12-18 个月内预期相对基准指数涨幅在 10%以上, 基准定义如下

**中性**, 未来 12-18 个月内预期相对基准指数变化不大, 基准定义如下。根据 FINRA/NYSE 的评级分布规则, 我们会将中性评级划入持有这一类别。

**弱于大市**, 未来 12-18 个月内预期相对基准指数跌幅在 10%以上, 基准定义如下

各地股票基准指数: 日本 – TOPIX, 韩国 – KOSPI, 台湾 – TAIEX, 印度 – Nifty100, 美国 – SP500; 其他所有中国概念股 – MSCI China.

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### Analyst Stock Ratings

**Outperform:** The stock's total return over the next 12-18 months is expected to exceed the return of its relevant broad market benchmark, as indicated below.

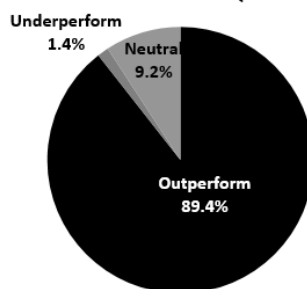
**Neutral:** The stock's total return over the next 12-18 months is expected to be in line with the return of its relevant broad market benchmark, as indicated below. For purposes only of FINRA/NYSE ratings distribution rules, our Neutral rating falls into a hold rating category.

**Underperform:** The stock's total return over the next 12-18 months is expected to be below the return of its relevant broad market benchmark, as indicated below.

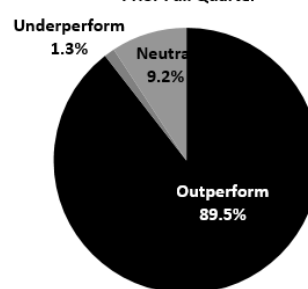
**Benchmarks for each stock's listed region are as follows: Japan – TOPIX, Korea – KOSPI, Taiwan – TAIEX, India – Nifty100, US – SP500; for all other China-concept stocks – MSCI China.**

## 评级分布 Rating Distribution

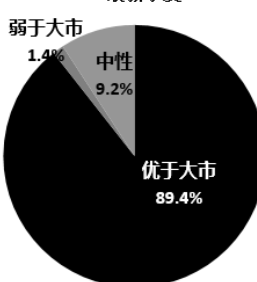
Most Recent Full Quarter



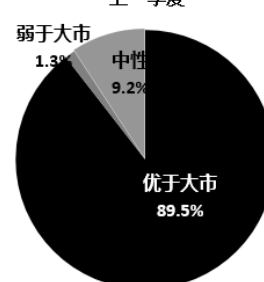
Prior Full Quarter



最新季度



上一季度



## 截至 2022 年 9 月 30 日海通国际股票研究评级分布

	优于大市	中性 (持有)	弱于大市
海通国际股票研究覆盖率	89.4%	9.2%	1.4%
投资银行客户*	5.5%	6.8%	4.5%

\*在每个评级类别里投资银行客户所占的百分比。

上述分布中的买入, 中性和卖出分别对应我们当前优于大市, 中性和落后大市评级。

只有根据 FINRA/NYSE 的评级分布规则, 我们才将中性评级划入持有这一类别。请注意在上表中不包含非评级的股票。

### 此前的评级系统定义 (直至 2020 年 6 月 30 日):

买入, 未来 12-18 个月内预期相对基准指数涨幅在 10%以上, 基准定义如下

中性, 未来 12-18 个月内预期相对基准指数变化不大, 基准定义如下。根据 FINRA/NYSE 的评级分布规则, 我们会将中性评级划入持有这一类别。

卖出，未来 12-18 个月内预期相对基准指数跌幅在 10%以上，基准定义如下

各地股票基准指数：日本 – TOPIX, 韩国 – KOSPI, 台湾 – TAIEX, 印度 – Nifty100; 其他所有中国概念股 – MSCI China.

#### Haitong International Equity Research Ratings Distribution, as of Sep 30, 2022

	Outperform	Neutral (hold)	Underperform
HTI Equity Research Coverage	89.4%	9.2%	1.4%
IB clients*	5.5%	6.8%	4.5%

\*Percentage of investment banking clients in each rating category.

BUY, Neutral, and SELL in the above distribution correspond to our current ratings of Outperform, Neutral, and Underperform.

For purposes only of FINRA/NYSE ratings distribution rules, our Neutral rating falls into a hold rating category. Please note that stocks with an NR designation are not included in the table above.

#### Previous rating system definitions (until 30 Jun 2020):

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**NEUTRAL:** The stock's total return over the next 12-18 months is expected to be in line with the return of its relevant broad market benchmark, as indicated below. For purposes only of FINRA/NYSE ratings distribution rules, our Neutral rating falls into a hold rating category.

**SELL:** The stock's total return over the next 12-18 months is expected to be below the return of its relevant broad market benchmark, as indicated below.

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