

# Health Savvy

*Building better LLM Applications for Underrepresented Health Conditions with*

**truera**



# OUR TEAM



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Full-Stack Developer

# The Problems



Health  
Savvy

Lack of Awareness  
and Information

PROBLEM 1

Quality Disparities in  
Medical  
Consultations

PROBLEM 2

Fragmented Support  
for Uncommon  
Medical Issues

PROBLEM 3



# ***SOLUTIONS***





# TMJ & Orofacial AI Physical Therapist



More Cost Effective



Grounded Information



Accessible anywhere,  
anytime

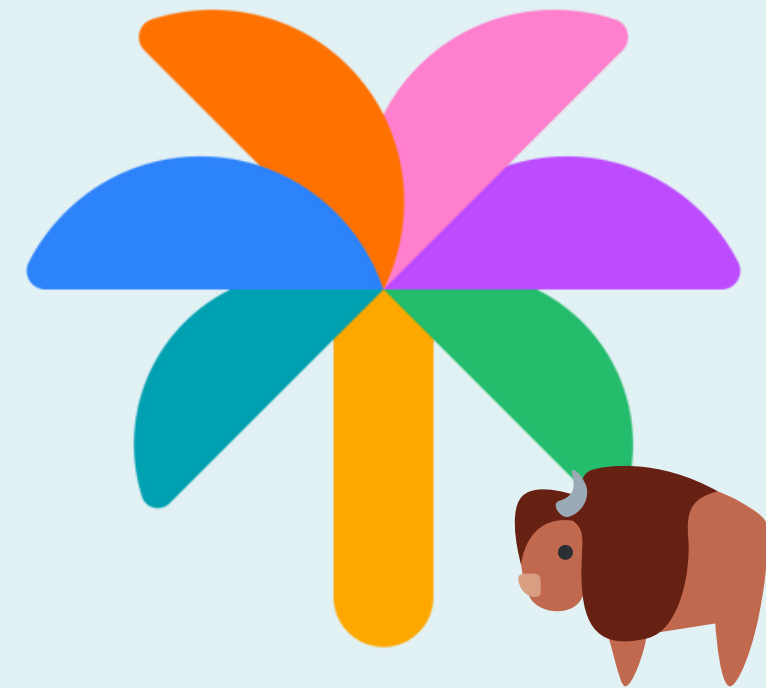


Providing insightful guidance  
with unlimited knowledge



# TruLens: Compare GPT4-vision vs Custom Trained Model

TRULENS COMPARISON



*Classification Model*



```
image_documents = SimpleDirectoryReader(input_files=["/content/jaw.png"]).load_data()

openai_mm_llm = OpenAIMultiModal(
    model="gpt-4-vision-preview", api_key=OPENAI_API_TOKEN, max_new_tokens=200
)

response_1 = openai_mm_llm.complete(
    prompt='''
Which of the steps is the Goldfish exercise displayed in the photo?:
'1. Place your tongue on the roof of your mouth behind your front teeth',
'2. Place a finger on your TMJ and one on your chin',
'3. Open your mouth allowing your jaw to drop down and close.',
'4. Repeat 8 times'
Give a response directed at the person in the photo
If the image is unclear, ask for additional information or clarification.
''',
    image_documents=image_documents,
)
```

# GPT4 Vision



It looks like you're performing step 2 of the Goldfish exercise. You have placed one finger on your TMJ (temporomandibular joint), which is located just in front of your ear, and the other finger on your chin. This is the correct positioning to help guide the motion for the next steps of the exercise. Remember to proceed gently with the opening and closing of your mouth for step 3, and to repeat the exercise 8 times as mentioned in step 4. Keep up the good work!

**GPT4 Vision**

```

vertexai.init(project="healthsavvy", location="us-central1")
parameters = {
    "candidate_count": 1,
    "max_output_tokens": 200,
    "temperature": 0.2,
    "top_p": 0.8,
    "top_k": 40
}
model = TextGenerationModel.from_pretrained("text-bison")
response = model.predict(
    f"""
A user submits an image our classification model predicts is 70% probable they are doing
the Goldfish TMJ exercise. Give a response directed at the person in the photo
If the probability is too low, suggest some ways to improve given the following steps to
perform it properly:

'Goldfish Exercise 🐟',
'1. Place your tongue on the roof of your mouth behind your front teeth',
'2. Place a finger on your TMJ and one on your chin',
'3. Open your mouth allowing your jaw to drop down and close.',
'4. Repeat 8 times'
""",
    **parameters
)

```

# Custom Model

Hi there!

Based on the image you submitted, our model predicts that you are doing the Goldfish TMJ exercise with a 70% probability. That's great! However, there are a few things you can do to improve your form and get the most out of this exercise.

First, make sure that your tongue is placed firmly on the roof of your mouth behind your front teeth. This will help to create a seal and prevent air from escaping when you open your mouth.

Second, place your fingers on your TMJ (the joint in front of your ear) and one on your chin. This will help you to feel the movement of your jaw as you open and close your mouth.

Finally, when you open your mouth, allow your jaw to drop down and close completely. Don't hold back or clench your teeth. This will help to stretch the muscles and ligaments around your TMJ and relieve pain.

Repeat this exercise 8 times

**Custom Model**



# CUSTOM DATA SET



YouTube

Search

**RESISTED OPEN**

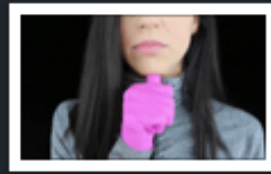
0:40 / 2:40 · Resisted Open >

7 Best TMJ Exercises to RELIEVE Jaw Pain

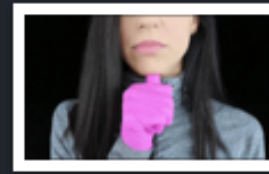
Teeth Talk Girl  
429K subscribers

Join Subscribe

741 | Share | Download



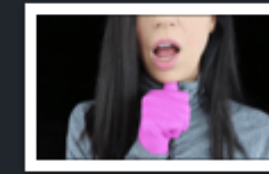
1.png



2.png



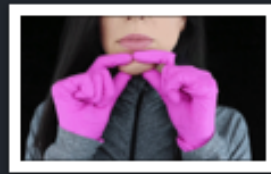
3.png



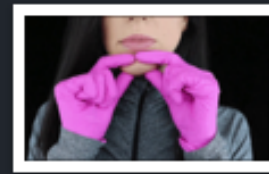
4.png



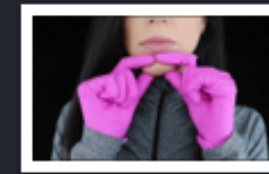
5.png



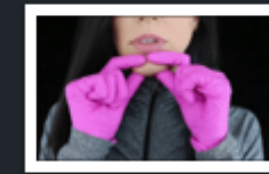
6.png



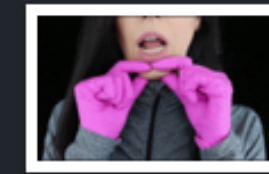
7.png



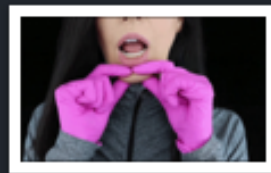
8.png



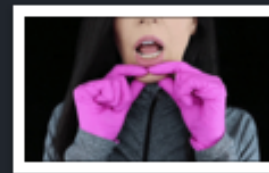
9.png



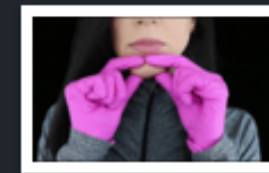
10.png



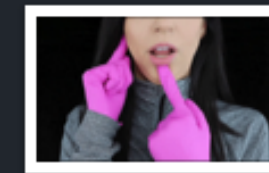
11.png



12.png



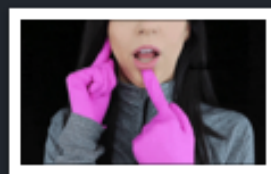
13.png



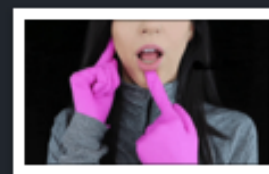
14.png



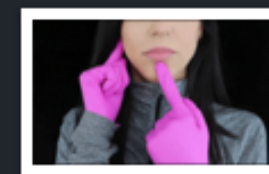
15.png



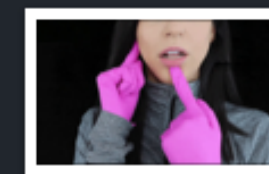
16.png



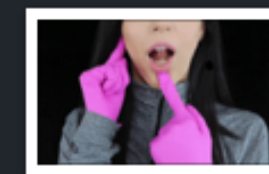
17.png



18.png



19.png



20.png

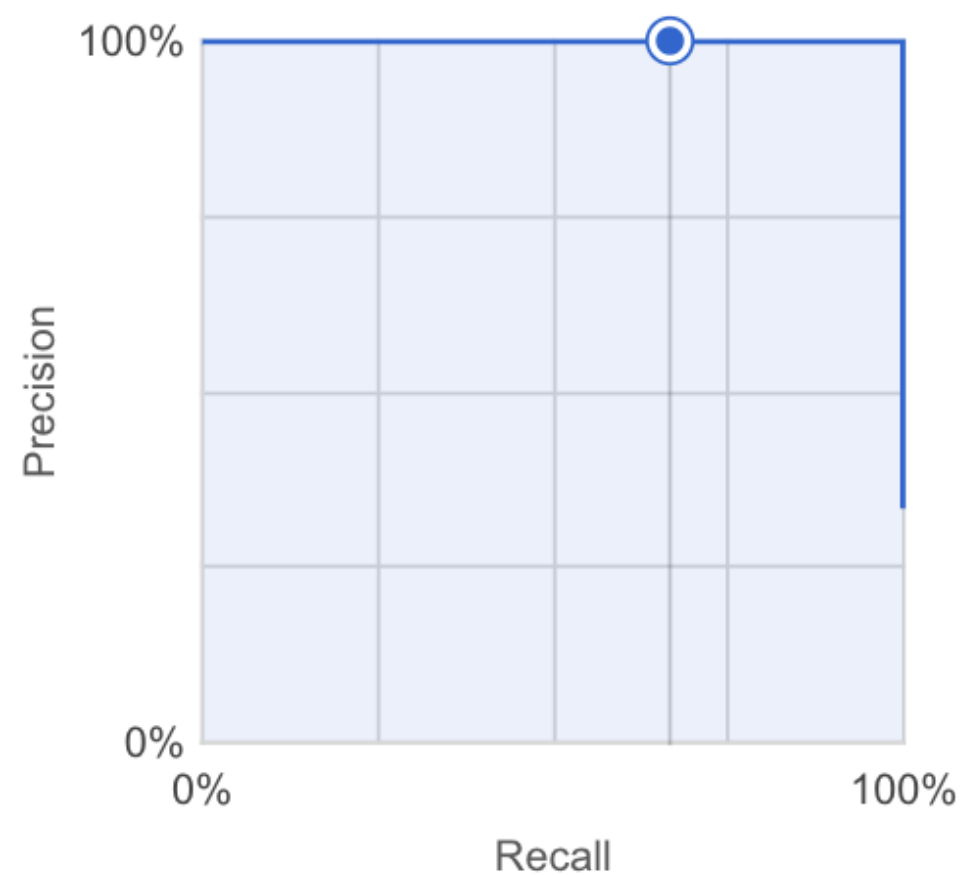


## All labels

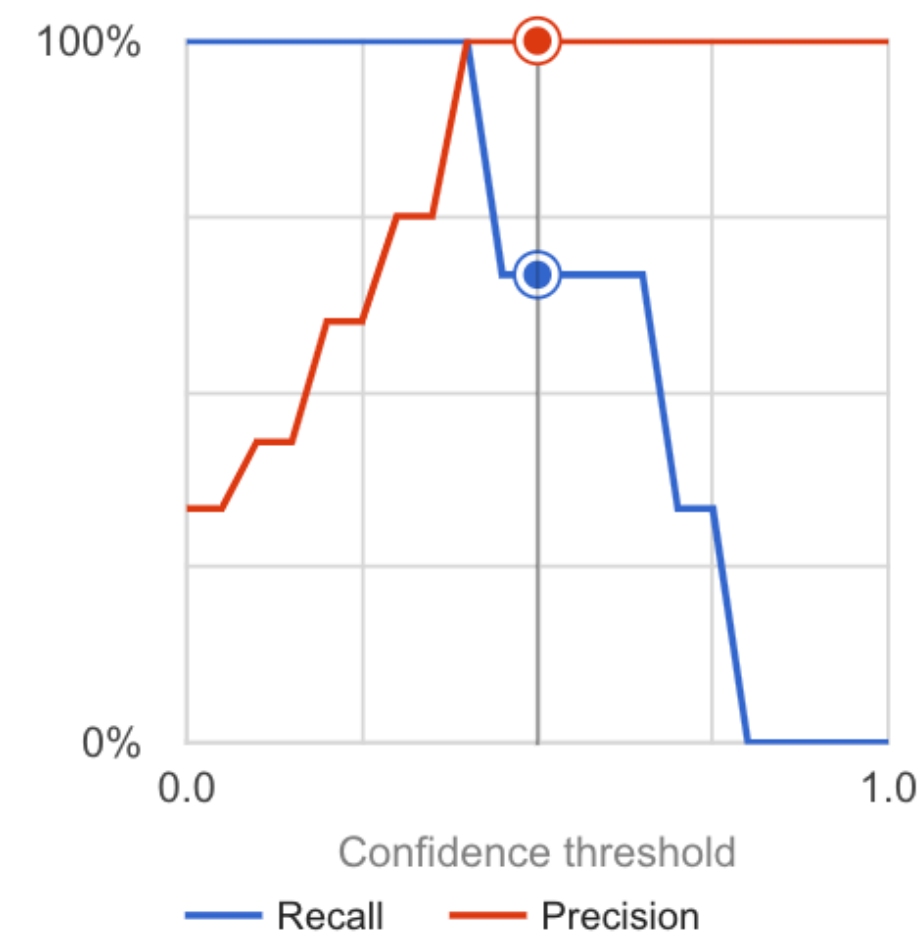
Average precision <span>?</span>	1
Precision <span>?</span>	100%
Recall <span>?</span>	66.7%
Created	Dec 5, 2023, 8:20:19 PM
Total images	20
Training images	14
Validation images	3
Test images	3

To evaluate your model, set the **confidence threshold** to see how precision and recall are affected. The best confidence threshold depends on your use case. Read some [example scenarios](#) [↗](#) to learn how evaluation metrics can be used.

### Precision-recall curve ?



### Precision-recall by threshold ?





# Physical Therapy AI

No predicted exercise available.



Goldfish



Resisted Close



Resisted Open

Turn on camera

Message Physical Therapy AI...

Submit



# Question/Answer Relevance Between Overall Question and Answer.

```
✓  
6s [58] print("GPT4-vision Results: ", fopenai.relevance_with_cot_reasons(response_1, prompt1))  
      print("Custom Vertex-AI Model Results: ", fopenai.relevance_with_cot_reasons(response.text, prompt2))
```

```
GPT4-vision Results: (0.9, {'reason': 'Criteria: The response should accurately identify the step of the  
Custom Vertex-AI Model Results: (1.0, {'reason': 'Criteria: The response provides relevant information a
```

# TruLens: Relevance GPT4-vision vs Custom Trained



0.9

'**reason**': 'Criteria: The response should accurately identify the step of the Goldfish exercise displayed in the photo and provide a relevant response to the person in the photo.'  
**Supporting Evidence**: The response asks a question about the step of the exercise displayed in the photo and provides a prompt for the person in the photo to respond.'

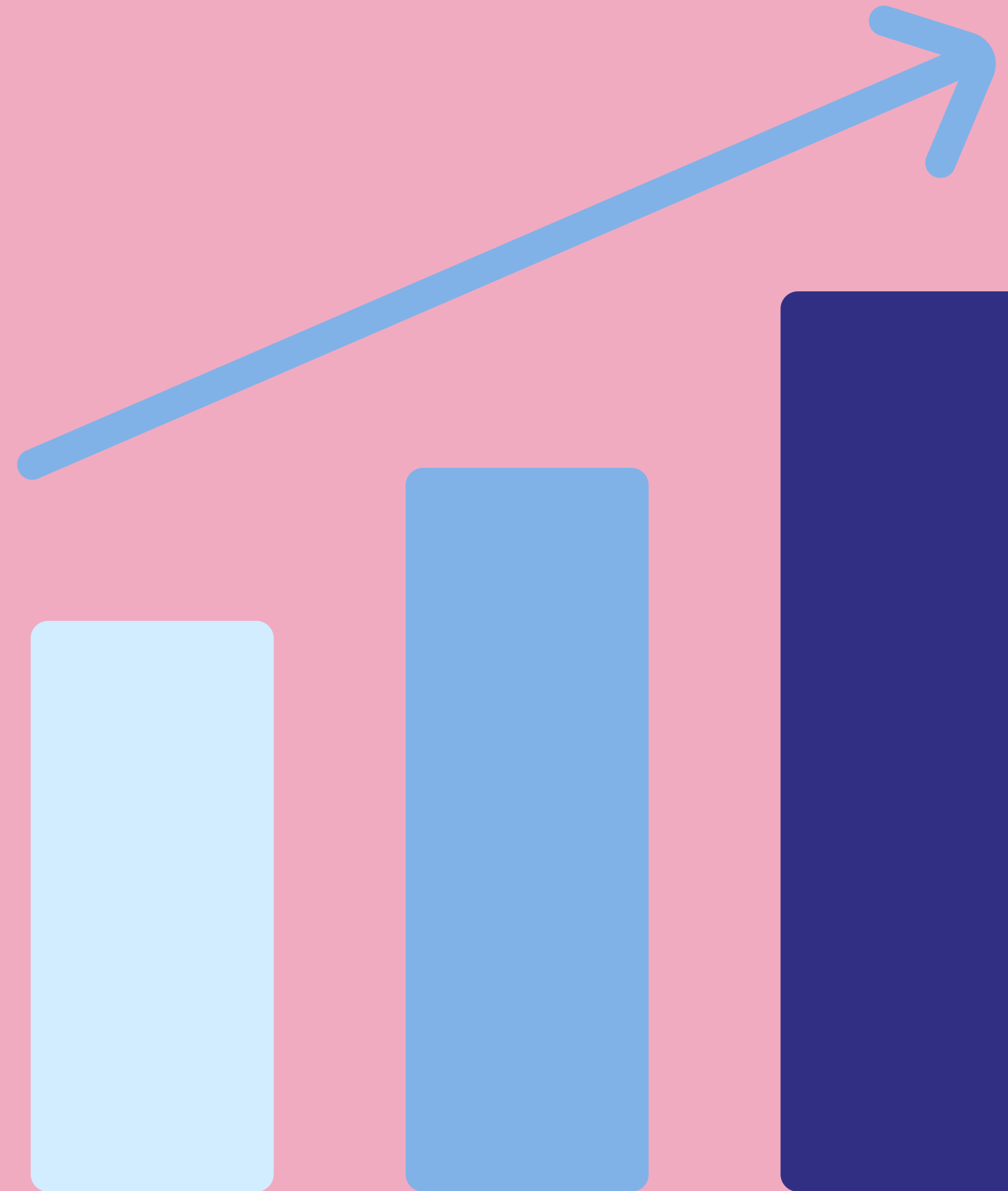


1.0

'**reason**': 'Criteria: The response provides relevant information and guidance to the person in the photo regarding the Goldfish TMJ exercise.'  
**Supporting Evidence**: The response acknowledges that the person in the photo is doing the Goldfish TMJ exercise and provides steps to improve their form. It mentions the importance of placing the tongue on the roof of the mouth, placing fingers on the TMJ and chin, and allowing the jaw to drop down and close completely. It also mentions the repetition of the exercise 8 times.

# Improve Shared Information it's Relevance

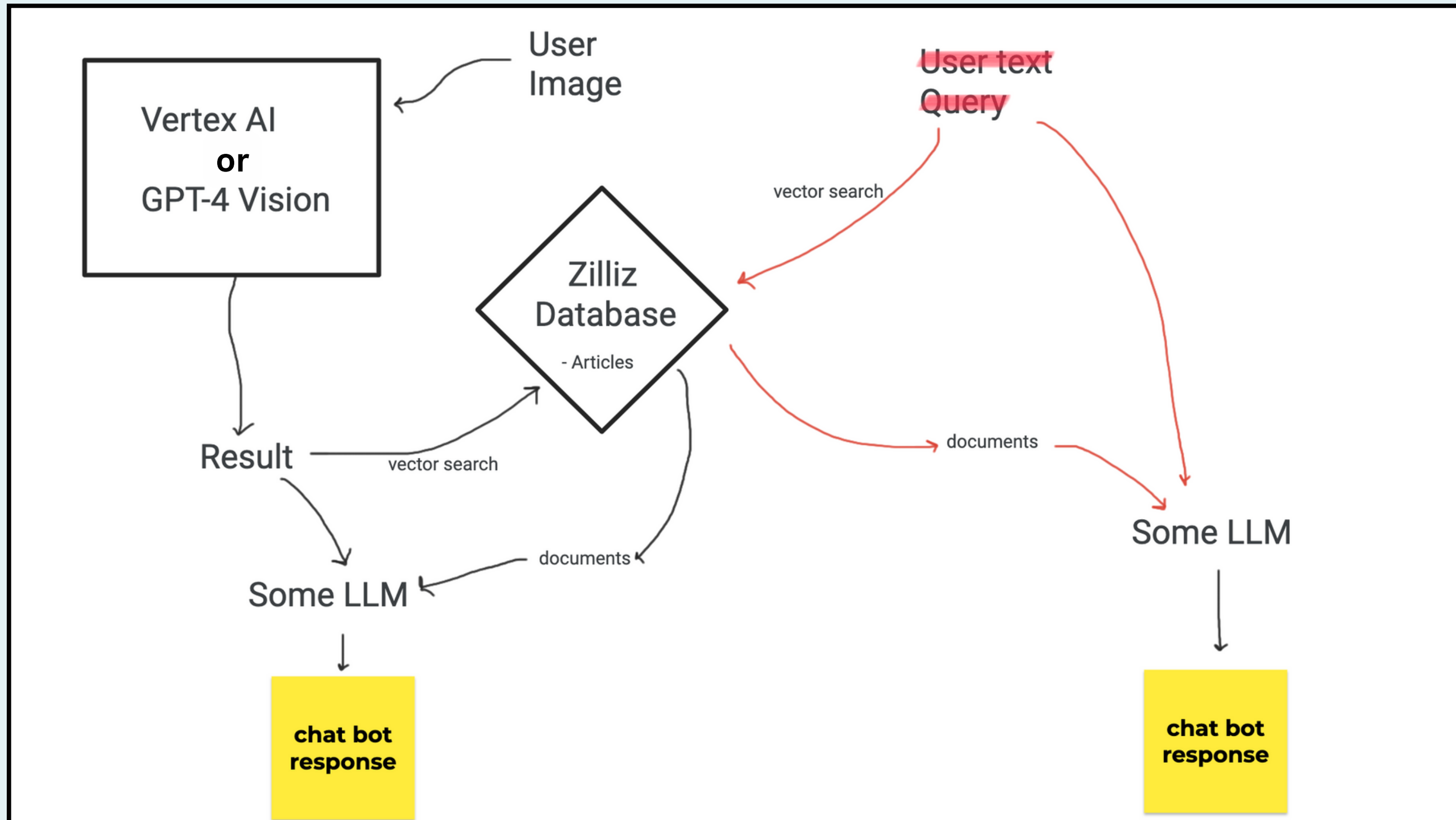
RAG AND EVALUATING WITH TRULENS





# Ensuring Reliable Insights

COMPARING LLM OUTPUT WITH AND WITHOUT RAG INSIGHTS



# Ensuring Reliable Insights

COMPARING LLM OUTPUT WITH AND WITHOUT RAG INSIGHTS

## Effects of Jaw-Opening Exercises with/without Pain for Temporomandibular Disorders: A Pilot Randomized Controlled Trial

Shoko Tobe<sup>1</sup>,  
Kenji Fueki<sup>1</sup>

Affiliations + e

PMID: 2655472

Systematic Review

## Effectiveness of Physical Therapy Interventions for Temporomandibular Disorders Associated with Tinnitus: A Systematic Review

Marianna Traiano da Silva<sup>1</sup>, Carlos Silva<sup>2</sup>, Jade Silva<sup>2</sup>, Mateus Costa<sup>2</sup>, Inae Gadotti<sup>3</sup>

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## The Effect of Physical Therapy Treatment in Patients with Subjective Tinnitus: A Systematic Review

Sarah Michiels<sup>1,2\*</sup>, Sebastia  
Corine M. Visscher<sup>6</sup>, Annick

<sup>1</sup> Department of Rehabilitation Science  
Antwerp, Belgium, <sup>2</sup> Department of Oral  
Motor Centre Antwerp, University of Antwerp,  
Medicine and Health Sciences, University  
Hospital, Edegem, Belgium, <sup>3</sup> Department of  
University of Amsterdam and VU University  
Social Welfare, University College Ghent

**Background:** Tinnitus is a common condition that  
decreases the patient's quality of life.



International Journal of Therapies & Rehabilitation  
Research

<http://www.scopemed.org/?jid=12>

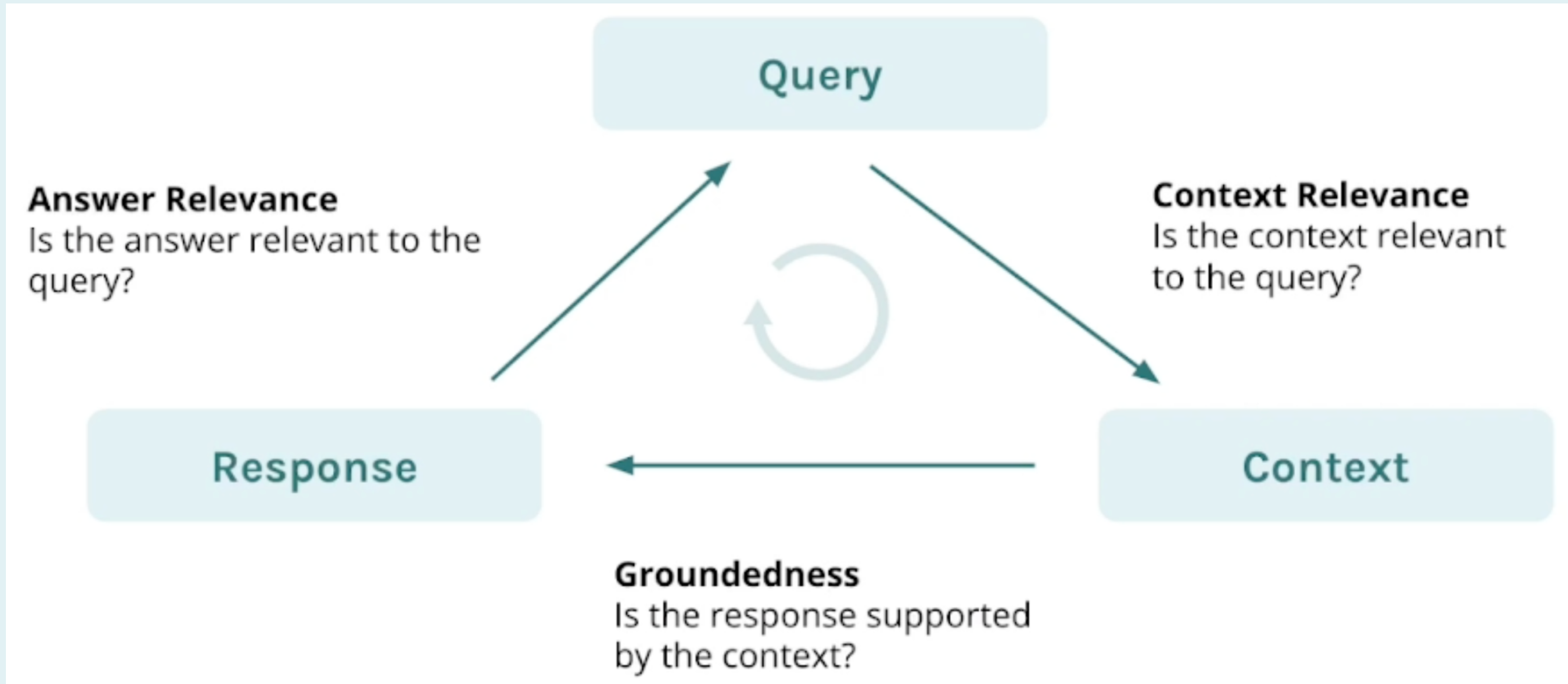
E-ISSN  
2278-0343

**EFFECT OF GOLDFISH EXERCISE ON PAIN, MOUTH OPENING AND  
TEMPOROMANDIBULAR JOINT DISABILITY IN ORAL  
SUBMUCOUS FIBROSIS- A RANDOMIZED CONTROLLED TRIAL**



# Ensuring Reliable Insights

COMPARING LLM OUTPUT WITH AND WITHOUT RAG INSIGHTS



## **Response:**

Excellent! It appears you're practicing the Goldfish exercise, a valuable technique for strengthening your temporomandibular joint (TMJ). You've correctly positioned your fingers on the TMJ, just in front of your ear, and on your chin. This positioning will guide the motion for the next steps.

As you proceed to step 3, remember to gently open and close your mouth, allowing your finger to guide the movement. Repeat this exercise 6 times, as suggested in the research.

The Goldfish exercise has been studied for its effectiveness in improving TMJ function. A study comparing the Goldfish exercise with other techniques found that it led to a statistical improvement in mouth opening and TMJ disability, while mouth opening alone did not show a significant difference. This suggests that the Goldfish exercise may enhance overall oral function and intake by increasing mouth opening and reducing discomfort.

The principle behind the Goldfish exercise mimics the pulsatile motion of goldfish in water. By imitating this movement, the exercise helps improve jaw function and alleviate pain associated with TMJ disorders.

Keep up the great work! Remember to consult with a healthcare professional or a physical therapist if you have any concerns or experience pain during the exercise.



# Context:

" Heading: Goldfish Exercises to Strengthen Your Temporomandibular Joint There are two variations to this jaw exercise for TMJD. A partial goldfish involves placing your tongue on the roof of the mouth, then placing one finger in front of your ear on the TMJ. Then, place the pointer finger of your other hand on your chin. Use your finger to drop your jaw halfway open and then close it. There should be a little bit of resistance, but no pain. A full goldfish is the same as above, except that you use your finger to drop your jaw all the way down and then back up again. Either of these exercises should be done in rounds of six. Each round can be completed six times a day. Heading: Resisted Mouth Movement Exercise to Strengthen the TMJ Using resisted mouth opening and closing helps build up strength in the temporomandibular joint. The resisted",

" involves placing your thumb under your chin, then opening your mouth slowly. Apply a little resistance by pushing gently against your chin using your thumb. Resisted closing is similar. Use your index fingers and thumbs on both hands to squeeze your chin. Then, drop your jaw down to open your mouth. Use your fingers to apply gentle resistance to your chin while trying to close your mouth. Heading: Resisted closing of the mouth Resisted closing of the mouth is a great exercise to help relieve pain associated with temporomandibular joint (TMJ) disorder. Do this exercise using a resistance device specifically designed for this purpose. The goal is to strengthen the muscles that open and close your jaw, reducing jaw and facial pain. Place the resistance device around your lower front teeth to do this exercise, and gently try to close your mouth. You should feel a slight tension as your muscles",

" statistical reduction of Pain & TMJ Disability while Mouth opening had no statistical significant difference. However there was some observable improvement in mouth opening which can be thought due to the therapeutic effect of ultrasound and active-passive stretching exercises and ice-cream sticks. Ultrasound accelerates the healing process, increases the extensibility of the collagen fibers and thereby breaks the fibrous bands and also causes pain relief. Isometric exercise prevents or minimizes muscle atrophy and maintains static strength. When both the groups were compared, Goldfish Exercise shows statistical improvement in Mouth opening & TMJ Disability & no difference in Pain. This may indicate that Goldfish Exercise does not individually have role on reduction of pain, but it does improve overall oral function & thereby oral intake of the patient by increasing mouth opening and reducing the disability. Goldfish Exercise works on the principle of pulsatile motion of Goldfish in water & thereby imitating",

" Title: EFFECT OF GOLDFISH EXERCISE ON PAIN, MOUTH OPENING AND TEMPOROMANDIBULAR JOINT DISABILITY IN ORAL SUBMUCOUS FIBROSIS- A RANDOMIZED CONTROLLED TRIAL Background: Oral SubMucous Fibrosis (OSMF) consists of facial pain and limited mouth opening. Restriction in mouth opening affects individual's day-to-day activities and even his health. Few studies have been done on effect of different exercises on Temporomandibular Joint (TMJ) Disorders.This study focuses on treating OSMF with Goldfish exercises. Aim: To study the effect of Goldfish exercise on Pain, Mouth opening and TMJ disability index in OSMF. Study Design: Randomized Controlled Trial. Method: 16 Patients with OSMF selected and divided into 2 groups. Group1:Received Goldfish exercise + Conventional Therapy & Group2:Received Conventional Therapy for 2 weeks. Conventional Therapy included Therapeutic ultrasound and gentle stretching exercises. Visual Analogue Scale (VAS), Mouth Opening (MO) and TMJ Disability Index were taken Pre & Post Treatment. Thereby data analysis was done using appropriate tests. Results:",

" 3secs hold, 6 times in 4 directions. GOLDFISH EXERCISE 8, 9 ☒ Place the tongue lightly on the top of the mouth. ☒ Open mouth as much as possible. ☒ Place 1 index finger on the TMJ. ☒ Place other on chin(for supported)/on other TMJ(for unsupported) ☒ Allow the jaw to drop down & raise back up with the help of index finger. ☒ Repeat 6 times. RESULTS • Data analysis was done using SPSS version 16.0 & Microsoft Excel 2007. The data collected by Mouth Opening were analyzed using parametric tests- Paired t-test was used for pre-post analysis & Unpaired t-test was used for between the group analysis; as the data is interval in nature. The data collected by Visual Analogue Scale & TMJ Disability Index were analyzed using non- parametric tests- Wilcoxon signed rank test was used for pre-post & Mann Whitney U- test for between the groups; as"

rag.query(f''''''




Improve the following response:

'It looks like you're performing step 2 of the Goldfish exercise. You have placed one finger on your TMJ (temporomandibular joint), which is located just in front of your ear, and the other finger on your chin. This is the correct positioning to help guide the motion for the next steps of the exercise. Remember to proceed gently with the opening and closing of your mouth for step 3, and to repeat the exercise 8 times as mentioned in step 4. Keep up the good work!'

by weaving in the response some info from these relevant peices of research: {documents}

''''')

# RAG v1 ?

Records	Average Latenc...	Total Cost (USD)	Total Tokens	Groundedness	Context Releva...	Answer Releva...
3	0	\$0	0	0.66  medium	0.57  low	1.0  high

Select App

```
rag.query(f"""
```

A user is doing the goldfish exercise and the LLM is to summarize these documents:

```
{documents}
```

```
and provide any additional feedback  
""")
```



# RAG v1 <sup>?</sup>

Records

4

Average Latenc...

0

Total Cost (USD)

\$0

Total Tokens

0

Groundedness

0.7

⚠ medium

Context Releva...

0.62

⚠ medium

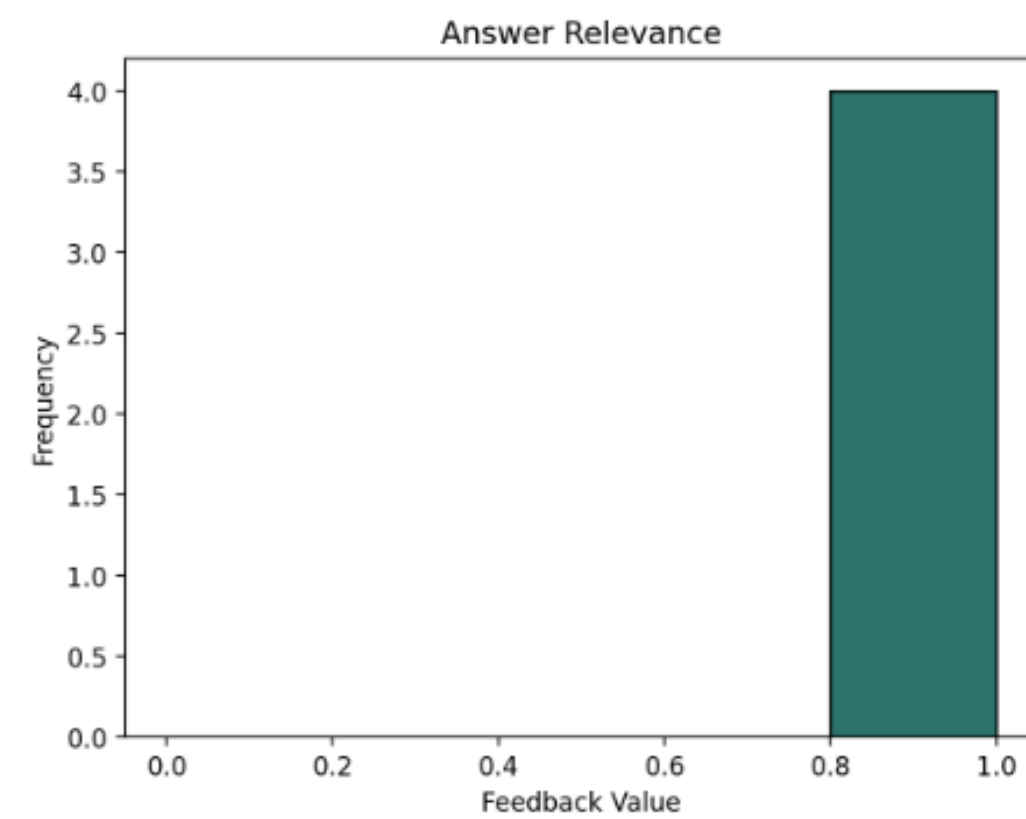
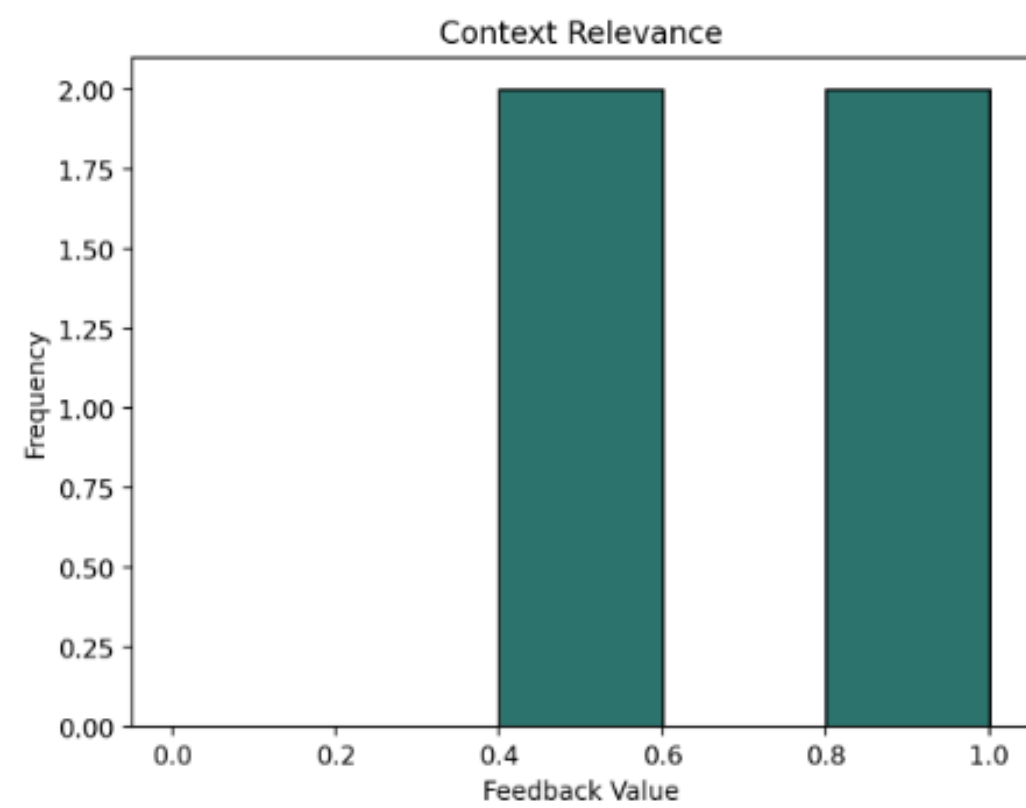
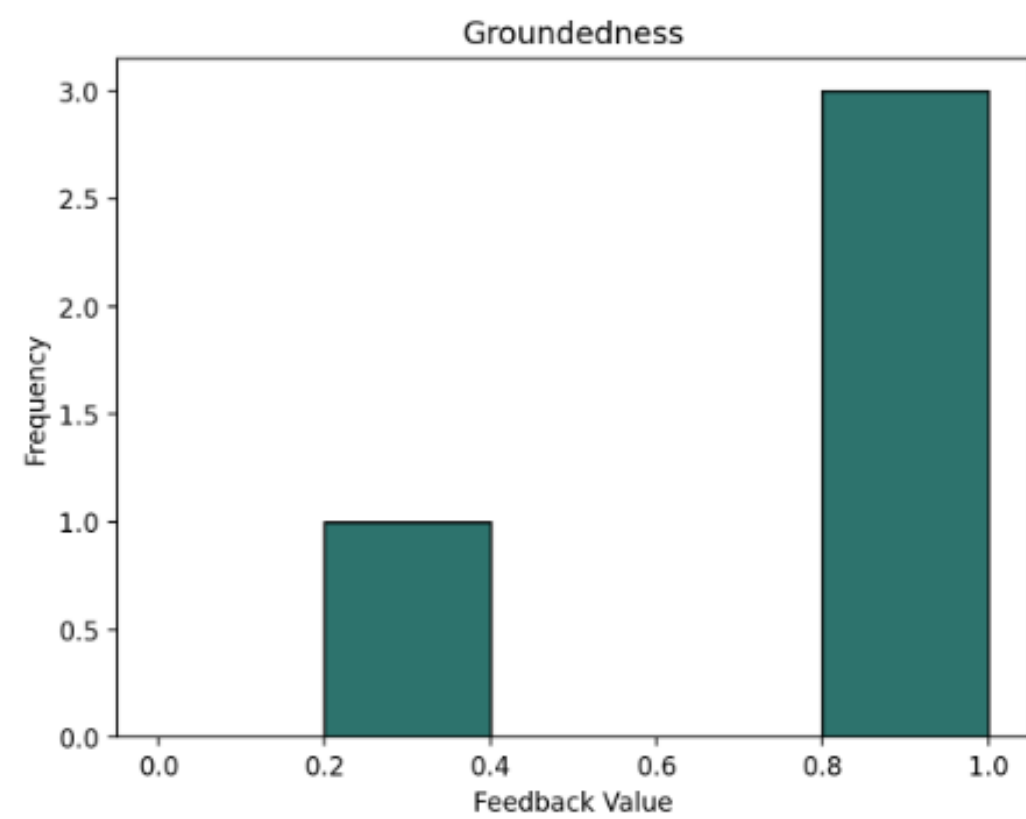
Answer Releva...

1.0

✅ high

Select App

## Records Feedback Functions



1.0

Query

0.62

**Answer Relevance**

Is the answer relevant to the query?

**Context Relevance**

Is the context relevant to the query?

Response

Context

0.7

**Groundedness**

Is the response supported by the context?



```
[35] print(grounded.groundedness_measure_with_cot_reasons(resp, query))  
      print(fopenai.qs_relevance_with_cot_reasons(resp, query))
```

```
({'statement_0': 0.0, 'statement_1': 1.0, 'statement_2': 1.0, 'statement_3': 1.0, 'statement_4': 1.0, 'statement_5': 1.0, 'statement_6': 1.0, 'statement_7': 1.0, 'statement_8': 1.0, 'statement_9': 1.0},  
{1.0, {'reason': 'Criteria: Relevance of the statement to the question'}}
```

# Groundedness Explained

{'statement\_0': 0.0, 'statement\_1': 1.0, 'statement\_2': 1.0, 'statement\_3': 1.0, 'statement\_4': 1.0}, {'reason': "Statement Sentence: A user is doing the goldfish exercise and the LLM is to summarize these documents:{Documents}"}

Supporting Evidence: NOTHING FOUND

**Score: 0**

Statement Sentence: Repeat this exercise 6 times, as suggested in the research.

Supporting Evidence: [' Heading: Goldfish Exercises to Strengthen Your Temporomandibular Joint There are two variations to this jaw exercise for TMJD. A partial goldfish involves placing your tongue on the roof of the mouth, then placing one finger in front of your ear on the TMJ. Then, place the pointer finger of your other hand on your chin. Use your finger to drop your jaw halfway open and then close it. There should be a little bit of resistance, but no pain. A full goldfish is the same as above, except that you use your finger to drop your jaw all the way down and then back up again. Either of these exercises should be done in rounds of six. Each round can be completed six times a day. Heading: Resisted Mouth Movement Exercise to Strengthen the TMJ Using resisted mouth opening and closing helps build up strength in the temporomandibular joint. The resisted']

**Score: 10**

Statement Sentence: The Goldfish exercise has been studied for its effectiveness in improving TMJ function.

Supporting Evidence: [' Heading: Goldfish Exercises to Strengthen Your Temporomandibular Joint There are two variations to this jaw exercise for TMJD. A partial goldfish involves placing your tongue on the roof of the mouth, then placing one finger in front of your ear on the TMJ. Then, place the pointer finger of your other hand on your chin. Use your finger to drop your jaw halfway open and then close it. There should be a little bit of resistance, but no pain. A full goldfish is the same as above, except that you use your finger to drop your jaw all the way down and then back up again. Either of these exercises should be done in rounds of six. Each round can be completed six times a day. Heading: Resisted Mouth Movement Exercise to Strengthen the TMJ Using resisted mouth opening and closing helps build up strength in the temporomandibular joint. The resisted']

**Score: 10**

Statement Sentence: The principle behind the Goldfish exercise mimics the pulsatile motion of goldfish in water.

Supporting Evidence: [' Heading: Goldfish Exercises to Strengthen Your Temporomandibular Joint There are two variations to this jaw exercise for TMJD. A partial goldfish involves placing your tongue on the roof of the mouth, then placing one finger in front of your ear on the TMJ. Then, place the pointer finger of your other hand on your chin. Use your finger to drop your jaw halfway open and then close it. There should be a little bit of resistance, but no pain. A full goldfish is the same as above, except that you use your finger to drop your jaw all the way down and then back up again. Either of these exercises should be done in rounds of six. Each round can be completed six times a day. Heading: Resisted Mouth Movement Exercise to Strengthen the TMJ Using resisted mouth opening and closing helps build up strength in the temporomandibular joint. The resisted']\nScore:

10\n\nStatement Sentence: Remember to consult with a healthcare professional or a physical therapist if you have any concerns or experience pain during the exercise.

Supporting Evidence: ['Keep up the great work! Remember to consult with a healthcare professional or a physical therapist if you have any concerns or experience pain during the exercise.']

**Score: 10**

INFORMATION OVERLAP: 8.0"}))



# Context Relevance Explained

(1.0,

{'reason': 'Criteria: Relevance of the statement to the question

Supporting Evidence: The statement provides information about the Goldfish exercise, which is the topic of the question. It describes the steps of the exercise and mentions that it has been studied for its effectiveness in improving TMJ function. It also mentions that the exercise may enhance overall oral function and reduce discomfort. This information is directly relevant to the question about the Goldfish exercise.'})

# What we Learned with TruLens

## We only were doing vector search

- Hybrid Search
- Experiment with multimodal database
  - image & text search
- *This could improve Context Relevance*

## Improve our Summarizer

- Experiment with Vectara as it is specialized in summarizing
- Combining summarized results with Chat-bison
- *This could improve Groundedness*