

Appendix

A. Experiment Prompt

Below we show the templates for the three prompting methods used for GPT-4V that we have examined in section 5.2:

A.1 Direct Prompting

You are given a piece of **Input Text** and an image. Your task is to predict whether misinformation is present. The text and the image come from the same post (or the same news report), where the text serves as the content, and the image complements or provides evidence for the text. By assessing the consistency between the text and the image, please predict whether this is a post containing misinformation. Please follow the Rules below:

Rules:

Generate a JSON object with three properties: 'label', 'explanation' and 'external knowledge'.

The return value of 'label' property should be selected from ["real", "fake"].

real indicates that no misinformation is detected.

fake indicates that misinformation is detected.

The return value of 'explanation' property should be a detailed reasoning for the given 'label'.

Note that your response will be passed to the python interpreter, SO NO OTHER WORDS!

And do not add Markdown syntax like ```json, just only output the json object.

Input Text:

{TEXT}

Your Response:

A.2 CoT Prompting

You are given a piece of ****Input Text**** and an image. Your task is to predict whether misinformation is present. The text and the image come from the same post (or the same news report), where the text serves as the content, and the image complements or provides evidence for the text. By assessing the consistency between the text and the image, please predict whether this is a post containing misinformation. Please follow the Rules below:

Rules:

1. Start your reasoning with an evaluation based on the sentence 'Let's think step by step'.
2. Output your complete reasoning in the subsequent lines.
3. In the final line, use a single word to indicate whether misinformation exists, which should be selected from ["Real", "Fake"].
"Real" indicates that no misinformation is detected.
"Fake" indicates that misinformation is detected.

Input Text:

{TEXT}

Your Response:

Let's think step by step,

A.3 LEMMA Prompting

A.3.1 Initial Stage Inference: The prompt for this stage resembles the one from A.1, with the addition of an example to preserve the output format. This is crucial for deriving the reasoning needed for subsequent steps.

You are given a piece of ****Input Text**** and an image. Your task is to predict whether misinformation is present. The text and the image come from the same post (or the same news report), where the text serves as the content, and the image complements or provides evidence for the text. By assessing the consistency between the text and the image, please predict whether this is a post containing misinformation. Please follow the Rules below:

Rules:

Generate a JSON object with three properties: 'label', 'explanation' and 'external knowledge'.

The return value of 'label' property should be selected from ["real", "fake"].

real indicates that no misinformation is detected.

fake indicates that misinformation is detected.

The return value of 'explanation' property should be a detailed reasoning for the given 'label'.

Note that your response will be passed to the python interpreter, SO NO OTHER WORDS!

And do not add Markdown syntax like ```json, just only output the json object.

Example output (JSON):

```
{{
  "label": "real",
  "explanation": "The image shows a concert venue filled with people who appear to be
enjoying a performance, which is consistent with the text's description of a photo
taken at the start of a concert in Paris. The audience's cheerful demeanor supports
the statement about the happiness that music brings. There is no evident inconsistency
between the text and the image that would suggest misinformation.",
}}
```

Input Text:

{TEXT}

Your Response:

A.3.2 External Knowledge: In section 4.1 of the paper, it's stated that LEMMA determines the need for external knowledge based on the initial stage inference. Thus, we assess the derived reasoning using two established rules from the prompt to decide. Subsequent stages proceed only if this stage returns True; otherwise, the decision from the initial stage is final.

You are given a piece of **Reasoning** about the first-stage decision of the authenticity of multimedia news post, the **Text** is the text part of the post and you have already got the image part of the post. Your task is to decide whether additional evidence is needed for predicting whether misinformation is present.

For deciding whether additional evidences are needed, please focus on two things:

1. Whether the authenticity of events is verified.
2. Whether the authenticity of the image is suspicious.

You should only respond in format as described below. DO NOT RETURN ANYTHING ELSE.

START YOUR RESPONSE WITH '{{'.

[response format]:

```
{{
  "explanation": "Why is the additional evidence needed or not?"
  "external knowledge": "Yes" if you think additional evidence is needed, "No"
otherwise.
}}
```

Input Reasoning:

{REASONING}

Input Text:

{TEXT}

Your Response:

A.3.3 Search Phrase Generation: At this stage, we input both original image-text pair post and the reasoning derived from A.3.1 to generate the following outputs: 1) a title for the post. 2) Two queries which are related to the content that needs to be verified.

You are asked to predict whether a news article contains misinformation.

The text of this news is:

{TEXT}

Your original prediction is {PREDICTION}. (0 for no misinformation, 1 for presence of misinformation, 'None' for no original prediction)

Your original reasoning based on that prediction is:

{REASONING}

External sources can better help you make the judgment. Please come up with a title for this news first, then list two questions/phrases/sentences that you would like to search on a public search engine, such as Google. Carefully design your question so that it can return the most helpful results for making your final prediction and reasoning. Please use English to generate your title and questions.

Text Input example 1:

is baltimore's prosecutor wrong about freddie grays legal knife the weapon police described is definitely illegal so why did marilyn mosby say it wasn't the answer hinges on a single spring

Output example (JSON) 1:

```
{{
  "title": "Freddie Gray's Knife: Legal or Not?",
  "questions": [
    "Was Freddie Gray's knife legal?",
    "Marilyn Mosby's comments on Freddie Gray's Legal Knife"
  ]
}}
```

Text Input example 2:

RT @danrem: Konon, inside The Bataclan concert before the attack. How life can change in a second. #Pray4Paris

Output example (JSON) 2:

```
{{
  "title":"Inside The Bataclan Concert Moments Before the Attack",
  "questions":[
    "the full story of what happened in the Bataclan | Paris attacks",
    "Authenticity of images from Bataclan before the attack"
  ]
}}
```

Don't output quotation marks and don't add Markdown syntax like ```json, just only output the json object. Your response:

A.3.4 Topic Relevance Filter: When we obtained the resources from search engine (We use title and queries derived from A.3.2 to search resources), we use the following prompt to iteratively check whether each search result is related to the context based on the queries and title we derived in A.3.2. Each resource will be labeled as True if relevant otherwise False.

Your task is to filter the off-topic search result. You will be provided a piece of text. You have to determine the topic of the text. Then, you will be provided the search result in JSON format. For each entry, there is a unique integer key serving as the id of each entry. The value of each entry consists of three attributes: title, body, url. And You have to filter the off-topic search result according to the content of the title and body. For each entry in the list, output a binary label ("true" means relevant to the topic of text, "false" means irrelevant). Put all the labels in a JSON dict

Example output format:

```
{{"0":true, "1":false, "2":false, "3":true, "4":false, "5":true, "6":false, "7":true}}
```

Text input that you are going to determine the topic:

```
{TEXT}
```

Search result in JSON format:

```
{SEARCH_RESULT}
```

Your answer (don't include the Markdown syntax like ``json. just directly output the JSON list object. Don't output anything else):

A.3.5 Evidence Extraction: When we finish the topic filter stage based on the derived labels for each resource, this stage conducts evidence extraction by quoting or summarizing the contents from derived resources.

You are given a piece of news/post. You are then provided a list of webpages retrieved from the Internet. For each webpage, please quote or summarize the text fragments that are relevant to the news/post. Return the quoted/summarized text as a new string. If the entire evidence is irrelevant to the news/post, please return an empty string. Try your best to only include the relevant fragment instead of returning the whole thing back. At the same time, do not waste any valuable information.

Example:

****News/Post:****

news/post text

****Webpages:****

```
[
    "relevant webpage 1",
    "irrelevant webpage 2",
    "relevant webpage 3"
]
```

****Output:****

```
{{
  "results": [
    "text in webpage 1 that is relevant to the news/post",
    "",
    "summary of content in webpage 3 that is relevant to the news/post"
  ]
}}
```

Your turn

****News/Post:****

{TEXT}

****Webpages:****

{EVIDENCE}

****Output:** (Don't output anything else except for the JSON object. Don't add Markdown syntax like ``json):**

A.3.6 Refined Prediction: Upon completing evidence extraction, the model reevaluates the image-text pair post, incorporating evidence from external resources. Additionally, a fine-grained definition of misinformation (The detail is presented as appendix B), as described in section 4.4, lines 419-421, is utilized for this reassessment.

Now we'll provide new references for you. Remember the image of news has already been provided.

And the following are new references:

First reference: Original Text

Here is the original text of the news:

{TEXT}

Second reference: External knowledge and facts.

Here are provided external news/articles/post/wikis that are related to the provided news topics. You can trust the authenticity of these resources.

The main effect of external knowledge is to check the factuality of the context and check whether there is a sardonicism existing in the image.

Begin of external resources:

{EXTERNAL}

End of external resources.

Now you have been provided all references and please look the definition of predefined categories

{DEFINITION}

Finally, based on the references and the definition of predefined categories, please firstly provide the improved reasoning and classify the news into one of the six predefined categories.

In one or more paragraphs, output your reasoning steps. In the final line, output your predicted category that this news belongs to. (Please don't output anything else except the category)

Your Response:

Let's think step by step,

B. Fine-grained definition of misinformation:

```
{  
  "True": "True content is accurate in accordance with fact. Eight of the subreddits  
fall into this category, such as usnews and mildlyinteresting. The former consists of  
posts from various news sites. The latter encompasses real photos with accurate  
captions.",  
  "Satire/Parody": "This category includes content that presents true contemporary  
information in a satirical or humorous manner, often leading to its misinterpretation  
as false. Examples can be found on platforms like Reddit's \"The Onion,\" featuring  
headlines such as \"Man Lowers Carbon Footprint By Bringing Reusable Bags Every Time  
He Buys Gas.\", Satire that clearly identifies itself as such and is intended purely  
for entertainment or social commentary purposes should not be considered  
misinformation.",  
  "Misleading Content": "This category comprises information deliberately manipulated  
to deceive the audience.",  
  "Imposter Content": "This category encompasses content generated by bots and  
trained on a vast array of other sources, aimed at impersonating genuine human  
activity.",  
  "False Connection": "This category encompasses instances where there is a  
disconnect between the information conveyed by an image and the essential details  
provided in the accompanying text. It may involve situations where the event depicted  
in the image does not align with or contradicts the narrative described in the text,  
leading to potential misinterpretation or misunderstanding.",  
  "Manipulated Content": "This category consists of content that has been  
intentionally altered through manual photo editing or other forms of manipulation. For  
instance, comments on platforms like the \"photoshopbattles\" subreddit often contain  
doctored versions of images submitted to the platform.",  
  "Unverified": "This category includes news or content for which the presence of  
misinformation cannot be definitively determined based solely on the available  
evidence. Additional evidence or verification may be required to confirm or refute the  
accuracy of the information. This category encompasses situations where there is  
insufficient information or conflicting sources to make a conclusive determination  
regarding the accuracy of the content."  
}
```

C. Example

Content of Post

"Husband Gave His Unfaithful Ex-Wife Half Of Everything He Owned - Literally
<https://t.co/9Ot0mQAcQ3\u2026> <https://t.co/EXXQb1b708\u2026>"

Image of Post



Output of First Stage Inference (A.3.1)

Lemma Component Direct: Starting...

```
{'label': 'real', 'explanation': "The image shows a car and a laptop that have been cut in half, which visually supports the claim made in the text that a husband gave his unfaithful ex-wife half of everything he owned. The literal halving of these items is consistent with the text's narrative, suggesting that the image is used to emphasize the extreme measures taken by the husband as described in the story. There is no clear discrepancy between the text and the image that would indicate misinformation."}
```

Output of External Knowledge (A.3.2)

Need External Knowledge: 1

The image shows items that have been cut in half, which could be interpreted as supporting the text's claim. However, without additional context, it's not possible to verify the authenticity of the events or the intention behind the image. The image alone does not provide enough information to confirm the story, and it could have been staged or altered for effect. Therefore, additional evidence is needed to determine the authenticity of the events and to confirm that the image is not misleading.

Output of Search Phrase Generation (A.3.3)

Lemma Component question_gen: Starting...

Title: Man Divides Possessions in Half After Divorce

Questions: ['Man cuts all his belongings in half after divorce news', 'Is the story of a husband cutting his possessions in half true?']

Output of Topic Relevance Filter (A.3.4)

Original Search Results:

```
{'Man Divides Possessions in Half After Divorce': [{'title': 'Video of divorced man cutting possessions in half to give to ex is fake ...', 'href': 'https://globalnews.ca/news/2068296/video-of-divorced-man-cutting-possessions-in-half-
```

to-give-to-ex-is-fake/', 'body': '1 min read. TORONTO - The video of a German man cutting all of his possessions in half to give to his ex-wife after a bitter divorce is fake. The video that went viral last week, and was picked ...'}, {'title': 'Für Laura | Snopes.com', 'href': 'https://www.snopes.com/fact-check/fur-laura/', 'body': 'FALSE. Origins: On 16 June 2015, a YouTube video purportedly showing a man cutting all of his possessions in half in the aftermath of a divorce went viral: "Thank you for 12 \'beautiful years ...\''}, {'title': "Today's Fake Video: That Guy Who Cut Everything in Half For ... - Gizmodo", 'href': 'https://gizmodo.com/todays-fake-that-guy-who-cut-everything-in-half-for-hi-1713065476', 'body': 'The video below has gone viral, blowing up on Reddit, Time, and yes, Gizmodo. But the video is actually a marketing stunt from a German website that helps people find lawyers. The man was ...'}, {'title': 'Fake News: Man Sawed Possesions In Half After Divorce', 'href': 'https://medium.com/@cjasinskil/fake-news-man-sawed-possesions-in-half-after-divorce-d9ab7dab9f1f', 'body': 'In June 2015, a story went viral about a German man who had sawed all his possessions in half after his wife divorced him. The story was accompanied by a video showing the man's sawed-in-half car...'}, {'title': 'German Man Going Through Divorce Cuts Belongings in Half | TIME', 'href': 'https://time.com/3928145/german-man-divorce-ebay-video-half/', 'body': 'A viral video on YouTube appears to show a German man cutting everything he and his wife own in half because they are splitting up. In the clip, uploaded by the user "Der Juli," a man saws a ...'}], 'Man cuts all his belongings in half after divorce news': [{'title': 'Husband Gave His Unfaithful Ex-Wife Half Of Everything He Owned ...', 'href': 'https://www.boredpanda.com/half-of-everything-divorce-laura/', 'body': 'Divorce settlements, which often force the two estranged spouses to split their belongings 50/50, can be both emotionally and financially painful. In an unambiguous and ironic gesture, one man in Germany told Laura, his ex-wife, just what he thought of her - by literally cutting all of their belongings in half!'}, {'title': 'German Man Going Through Divorce Cuts Belongings in Half | TIME', 'href': 'https://time.com/3928145/german-man-divorce-ebay-video-half/', 'body': 'A viral video on YouTube appears to show a German man cutting everything he and his wife own in half because they are splitting up. In the clip, uploaded by the user "Der Juli," a man saws a ...'}], {'title': 'Für Laura | Snopes.com', 'href': 'https://www.snopes.com/fact-check/fur-laura/', 'body': 'FALSE. Origins: On 16 June 2015, a YouTube video purportedly showing a man cutting all of his possessions in half in the aftermath of a divorce went viral: "Thank you for 12 \'beautiful years ...\''}, {'title': 'This man literally gave his ex half of everything they owned - CNBC', 'href': 'https://www.cnbc.com/2015/06/18/this-man-literally-gave-his-ex-half-of-everything-he-owned.html', 'body': 'Following his divorce, this German man appears to have decided to split all of his belongings with his wife-literally. The disgruntled ex-husband, who goes by the name Der Juli online, posted a ...'}, {'title': 'German man cuts his belongings in HALF with power tools to give ex-wife ...', 'href': 'https://www.rt.com/news/268510-divorce-belongings-cut-half/', 'body': 'A German man has taken a court order to give his ex-wife half of his property after their divorce somewhat literally. He has cut up his stuff, from a car down to an iPhone, with power tools. He\'s now selling his share on eBay. The identity of the divorced man is unknown, but he goes by the name "Der Juli" online.'}], 'Is the story of a husband cutting his possessions in half true?': [{'title': 'Für Laura | Snopes.com', 'href': 'https://www.snopes.com/fact-check/fur-laura/', 'body': 'FALSE. Origins: On 16 June 2015, a YouTube video purportedly showing a man cutting all of his possessions in half in the aftermath of a divorce went viral: "Thank you for 12 \'beautiful years ...\''}, {'title': 'Husband Gave His Unfaithful Ex-Wife Half Of Everything He Owned ...', 'href': 'https://www.boredpanda.com/half-of-everything-divorce-laura/', 'body': 'In an unambiguous and ironic gesture, one man in Germany told Laura, his ex-wife, just what he thought of her - by literally cutting all of their belongings in half! The man is clearly experienced with the power tools that he has, because he\'s actually done a

great job of methodically and neatly destroying all of their stuff - everything ..."},
{'title': 'This man literally gave his ex half of everything they owned - CNBC',
'href':
'https://www.cnn.com/2015/06/18/this-man-literally-gave-his-ex-half-of-everything-he-owned.html', 'body': 'Following his divorce, this German man appears to have decided to split all of his belongings with his wife-literally. The disgruntled ex-husband, who goes by the name Der Juli online, posted a ...'}, {'title': 'Video of divorced man cutting possessions in half to give to ex is fake ...', 'href':
'https://globalnews.ca/news/2068296/video-of-divorced-man-cutting-possessions-in-half-to-give-to-ex-is-fake/', 'body': '1 min read. TORONTO - The video of a German man cutting all of his possessions in half to give to his ex-wife after a bitter divorce is fake. The video that went viral last week, and was picked ...'}, {'title': 'German Man Going Through Divorce Cuts Belongings in Half | TIME', 'href':
'https://time.com/3928145/german-man-divorce-ebay-video-half/', 'body': 'A viral video on YouTube appears to show a German man cutting everything he and his wife own in half because they are splitting up. In the clip, uploaded by the user "Der Juli," a man saws a ...'}}]

Filtered Search Results:

{'Man Divides Possessions in Half After Divorce': [{'title': 'Video of divorced man cutting possessions in half to give to ex is fake ...', 'href':
'https://globalnews.ca/news/2068296/video-of-divorced-man-cutting-possessions-in-half-to-give-to-ex-is-fake/', 'body': '1 min read. TORONTO - The video of a German man cutting all of his possessions in half to give to his ex-wife after a bitter divorce is fake. The vide'}, {'title': 'Fake News: Man Sawed Possesions In Half After Divorce', 'href':
'https://medium.com/@cjasinskil/fake-news-man-sawed-possesions-in-half-after-divorce-d9ab7dab9f1f', 'body': 'In June 2015, a story went viral about a German man who had sawed all his possessions in half after his wife divorced him. The story was accompanied b'}], 'Man cuts all his belongings in half after divorce news': [{'title': 'Husband Gave His Unfaithful Ex-Wife Half Of Everything He Owned ...', 'href':
'https://www.boredpanda.com/half-of-everything-divorce-laura/', 'body': 'Divorce settlements, which often force the two estranged spouses to split their belongings 50/50, can be both emotionally and financially painful. In '}, {'title': 'This man literally gave his ex half of everything they owned - CNBC', 'href':
'https://www.cnn.com/2015/06/18/this-man-literally-gave-his-ex-half-of-everything-he-owned.html', 'body': 'Following his divorce, this German man appears to have decided to split all of his belongings with his wife-literally. The disgruntled ex-husband, who'}, {'title': 'German man cuts his belongings in HALF with power tools to give ex-wife ...', 'href': 'https://www.rt.com/news/268510-divorce-belongings-cut-half/', 'body': 'A German man has taken a court order to give his ex-wife half of his property after their divorce somewhat literally. He has cut up his stuff, from a '}], 'Is the story of a husband cutting his possessions in half true?': [{'title': 'Husband Gave His Unfaithful Ex-Wife Half Of Everything He Owned ...', 'href':
'https://www.boredpanda.com/half-of-everything-divorce-laura/', 'body': 'In an unambiguous and ironic gesture, one man in Germany told Laura, his ex-wife, just what he thought of her - by literally cutting all of their belo'}, {'title': 'This man literally gave his ex half of everything they owned - CNBC', 'href':
'https://www.cnn.com/2015/06/18/this-man-literally-gave-his-ex-half-of-everything-he-owned.html', 'body': 'Following his divorce, this German man appears to have decided to split all of his belongings with his wife-literally. The disgruntled ex-husband, who'}, {'title': 'Video of divorced man cutting possessions in half to give to ex is fake ...', 'href':
'https://globalnews.ca/news/2068296/video-of-divorced-man-cutting-possessions-in-half-to-give-to-ex-is-fake/', 'body': '1 min read. TORONTO - The video of a German man cutting all of his possessions in half to give to his ex-wife after a bitter divorce

```
is fake. The vide'}, {'title': 'German Man Going Through Divorce Cuts Belongings in  
Half | TIME', 'href': 'https://time.com/3928145/german-man-divorce-ebay-video-half/',  
'body': 'A viral video on YouTube appears to show a German man cutting everything he  
and his wife own in half because they are splitting up. In the clip, uploa'}}}]}
```

Output of Evidence Extraction (A.3.5)

Evidence Extraction Results:

```
['The video of a German man cutting all of his possessions in half to give to his  
ex-wife after a bitter divorce is fake. The video that went viral last week, and was  
picked up by many media organizations (including Global News), was a marketing stunt  
, 'The story of the German man who sawed his possessions in half tapped into a common  
human desire for justice and vindication in the face of loss and betrayal. The video  
and accompanying news stories used dramatic imagery and a sensationalist tone to c']
```

Output of Refined Prediction (A.3.6)

Refined Prediction: 'fake'

Refined Explain: The original text of the news suggests a sensational story where a husband, in response to his wife's infidelity, gave her half of everything he owned by literally cutting his possessions in half. However, the external resources provided indicate that the story and the accompanying video are a hoax. Specifically, one of the external resources states that the video of the German man cutting his possessions in half was a marketing stunt and not a genuine act of post-divorce spite. This information directly contradicts the narrative suggested by the original text of the news.

The story plays on common themes of revenge and justice in the context of divorce, which could easily lead people to believe it's true due to the emotional response it may elicit. However, the fact that it has been revealed as a marketing stunt places it in the category of "Misleading Content." This is because the information was deliberately manipulated to deceive the audience into thinking it was a real event when it was not.