Executive Summary Ryoya Katafuchi, kkataryo1018@gmail.com

Key findings

1. The action that caused the fall is useful as information specific to Narrative.

2. It became clear that using ChatGPT is more advantageous than conventional methods for extracting that action.

3. Based on the combination of this action information and other columns, there is a suggestion that a more detailed analysis for each target seems to be possible.

Summary of your approach

   I believed that there is a preceding action that caused the fall as information unique to Narrative. While there is information about the object that caused the fall, it alone cannot infer the fundamental cause of the fall, leading to devising fall prevention measures. Hence, I focused on the information, "What action led to the fall?". If we can identify activities that are unsuitable for the elderly and actions that tend to cause falls, it might prompt those around them to provide support to prevent such falls, or it could be incorporated into product design. In this study, I conducted an analysis aimed at extracting motion information, examining the extraction results, and gaining insights combined with other columns.
   I used only Primary data and attempted to extract action information. I carried out the extraction of actions by morphological analysis and by ChatGPT using the OpenAI API. To simplify the experiment, I dealt with 300 data randomly sampled. In morphological analysis, I extracted verbs including for example gerunds, applied lemmatization, and collected verbs. In ChatGPT, I used a FewShotPrompt, provided multiple examples of verb extraction, and had ChatGPT extract action information. I present the prompt in Figure 1 and its results in Figure 2.
   In this study, I evaluate qualitatively by visual inspection. Traditional methods could only exhaustively extract verb words, and it's hard to imagine the action leading to the fall. On the other hand, ChatGPT understands the context and can correctly extract the actions leading to a fall. Moreover, it can extract not only verbs but also as a group of consecutive words, which means it can extract richer information. Furthermore, this information is specific to the Narrative. I also display the co-occurrence network in Figures 3 and 4. Unlike word clouds, the co-occurrence network visualizes the connection between words, so I believe that the story-like nature of the information is not lost, which is why I used it this time. When looking at both co-occurrence networks, the information extraction using ChatGPT can more precisely represent the situation of the action. For example, it can confirm common instances such as "slipping and falling" or "falling from a chair while trying something".
   Action information extracted by ChatGPT was found to be useful. Therefore, I looked at the differences between demographic groups by combining it with other columns. For simplicity, I compared the frequency of words indicating action information by attribute. Figure 5 shows the differences in frequently occurring words related to action information between genders, and Figure 6 shows the ones across age groups. Age is grouped by rounding down in 5-year increments. Since the data used here is very limited, I can't necessarily say there are significant differences, but some differences can be observed. For instance, in terms of gender differences, women tend to fall and trip more frequently on the floor. Incidentally, in this dataset, there are 114 males and 186 females. Regarding age, people aged 70-79 tend to trip more, which can be inferred to be due to the fact that many still walk regularly. On the other hand, people aged 80-89 have a higher tendency to fall from chairs, which could be deduced from the fact that they sit more often and are more prone to falls when they move. Through such observations, it became clear that when a full data analysis concerning action information is conducted, more valuable and reliable information can be expected.

Visualizations


```python
examples = [
    {
        "text": '94YOM FELL TO THE FLOOR AT THE NURSING HOME ONTO BACK OF HEAD SUSTAINED A SUBDURAL HEMATOMA',
        "verb": "FELL TO THE FLOOR"
    },
    {
        "text":
'87YOF WAS GETTING UP FROM THE COUCH AND FELL TO THE FLOOR SUSTAINED ABRASIONS TO ELBOWS ADMITTED FOR HEMORRHAGIC STROKE',
        "verb": "GETTING UP FROM THE COUCH"
    },
    {
        "text": '67YOF WAS AT A FRIENDS HOUSE AND  THAT WAS ON THE FLOOR AND SUSTAINED A RIGHT RADIUS FX',
        "verb": "SLIPPED ON WATER"
    },
]

example_formatter_template = """
text: {text}
verb: {verb}\n
"""
example_prompt = PromptTemplate(
    template=example_formatter_template,
    input_variables=["text", "verb"]
)

few_shot_prompt = FewShotPromptTemplate(
    examples=examples,
    example_prompt=example_prompt,
    prefix=
"These are sentences describing situations when elderly individuals fell. Please extract from the sentences the causes of t
he falls and the actions the elderly individuals took when they fell."
,
    suffix="text: {input}\nverb:",
    input_variables=["input"],
    example_separator="\n\n",

)

# ChatGPT Model
llm = OpenAI model_name="gpt-3.5-turbo",temperature=0)
    (
def extract_verbs_with_chatgpt(sentence):

    prompt_text = few_shot_prompt.format(input=sentence)
    answer = llm(prompt_text)
    print(f"TEXT: {sentence}")
    print(f"VERB: {answer}\n")
    return answer
```

Figure 1: Example of the prompt instructing action information extraction using the OpenAI API.

	Narrative	Morph	ChatGPT
57498	78yom was leaning forward to pick up something off the floor and lost his balance and fell striking his head dx: closed head injury; laceration scalp	[be, lean, pick, lose, fell, strike]	leaning forward to pick up something off the floor
91762	70 yof riding lawnmower accident, went over embankment, was in yard over night found by family. dx critical polytrauma, chest trauma, closed head injury	[rid, go, be, find, dx, close]	riding lawnmower accident, went over embankment
61136	68yom presents after a fall from a chair at the nursing home. pt states he slid off of the chair and often does this to get pain meds. dx: chronic midline lower back pain, low level fall, l2 compression fx	[pt, slide, do, get]	slid off of the chair
395	69yowm tripped and landed on floor at home. dx right tib fracture*	[land, dx]	tripped and landed on floor
81990	80 yom sat down on a rolling chair and was leaning over to dry off his dog when the chair slid out from under him.dx: thoracic compression fracture closed.	[sit, be, lean, dry, slide, close]	sat down on a rolling chair, leaning over to dry off his dog
60766	65yof was walking in a parking lot when she got her legs caught up in a discarded plastic bag and she fell onto outstretched arm dx: fractured right radius	[be, walk, get, catch, fell, outstretched, fracture]	got her legs caught up in a discarded plastic bag
72182	73yom pt was putting on his shirt when he fell backwards hitting upper back pain floor painful dx compression fracture thoracic	[be, put, fell, hit]	putting on his shirt
52710	86 yof biba from home following a fall, had tripped over a flower pot, c/o pain to right side of her pelvic area, had been drinking alcohol with the family, bal -184, dx: pubic rami fracture	[follow, have, trip, have, be, drink]	tripped over a flower pot
95673	80yof to er w/ daughter, daughter states that 2 days ago pt had fall on stairs while climbing them , pt denies hitting head orloc, pt has right knee pain & hip pain, pt also had fall today when getting up from chair dx fall, clsd fracture of right hip	[er, pt, have, fall, climb, hit, have, have, fall, get]	climbing stairs, getting up from chair
61629	75 yof tripped on clothing iron cord hit head dx hematoma forehead, chi	[trip, hit]	tripped on clothing iron cord
10950	87yof fall to floor walking to walker. unwitnessed, lives alone. found by son. + abrasion to lower leg, rectal bleed while on ***dx fx acetabulum, gastrointestinal hemorrhage	[walk, walker, live, find]	walking to walker
11301	68 yom was removing a post in his yard and fell landing on the wheel of the lawn mower on his right lower back. dx: right rib fracture	[be, remove, fell, land]	removing a post
76681	70yof with lumbar back pain following mechanical fall while stepping onto a stool to get back iner her bed at home. shse fell backwards, striking lumbar back and sacrum on the ground. reports low lumbar back pain. dx: lumbar strain;lumbar contusion	[follow, step, get, fell, strike]	stepping onto a stool
34533	86 yom trying to sit in chair and fell dx; chi, head lac	[try, sit, fell]	trying to sit in chair
98026	66yof, tripped over own shoe walking the dog and fell dx: closed fracture of distal end of left radius; dislocation of left ulnar styloid	[trip, walk, fell]	tripped over own shoe
2486	89yof was trying to open her mailbox and fell and sustained a contusion to hip	[be, try, open, fell, sustain, hip]	trying to open her mailbox
30861	83yof police went to pt's home for well-being check & found pt on floor; has mult abrasions/bruising to lt thigh,lt knee, rt knee & sternum dx: rhabdomyolysis #	[go, pt, find, have, abrasions/bruising, lt, rt]	found pt on floor
58861	74 yof tripped over shoes and fell in floor dx; l hip fx	[trip, fell]	tripped over shoes
45461	93yom was getting up from his wheelchair when he lost his balance and fell to the floor onto left hip dx: fractured left hip	[be, get, lose, fell, fracture, leave]	getting up from his wheelchair
59372	80yom fell while descending stairs, dx head inj with altered mental status	[fell, descend]	descending stairs

Figure 2: A part of the action information extraction results from the Narrative. The "Morph" column shows the results of verb extraction using morphological analysis. The "ChatGPT" column displays the results of action information extraction using the OpenAI API.
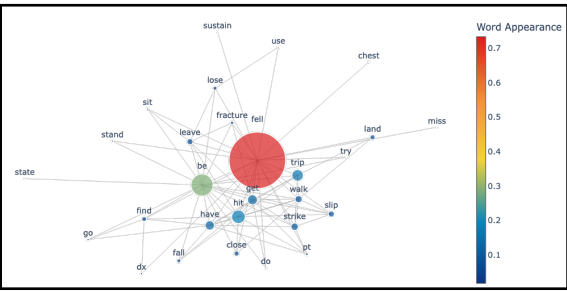
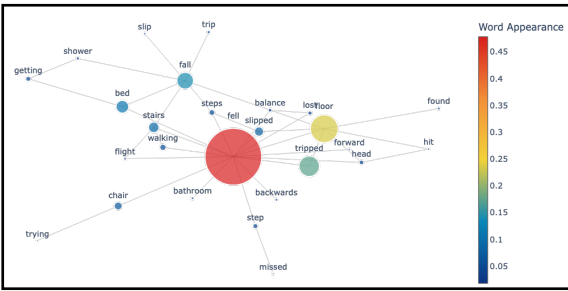Figure 3: Co-occurrence network based on action information extraction results from morphological analysis.

Figure 4: Co-occurrence network based on action information extraction results from OpenAI API.

	FEMALE	MALE
fell	85.0	49.0
floor	42.0	23.0
tripped	32.0	16.0
fall	23.0	16.0
bed	20.0	10.0
stairs	15.0	10.0
slipped	15.0	7.0
chair	10.0	10.0
walking	10.0	5.0
step	9.0	3.0
lost	8.0	2.0
steps	8.0	6.0
head	7.0	4.0
balance	7.0	2.0
trip	7.0	1.0
got	7.0	1.0
getting	7.0	5.0
bathroom	6.0	1.0
hit	5.0	1.0
get	5.0	3.0

Figure 5: Frequently occurring action-related words by gender.

	65	70	75	80	85	90	95	100
fell	18.0	16.0	26.0	30.0	23.0	13.0	7.0	1.0
floor	9.0	8.0	11.0	17.0	8.0	3.0	8.0	1.0
tripped	6.0	11.0	14.0	6.0	7.0	1.0	3.0	NaN
stairs	6.0	1.0	6.0	8.0	1.0	3.0	NaN	NaN
lost	4.0	1.0	NaN	3.0	1.0	1.0	NaN	NaN
balance	4.0	1.0	NaN	2.0	1.0	1.0	NaN	NaN
slipped	3.0	6.0	5.0	3.0	3.0	1.0	NaN	1.0
steps	3.0	3.0	3.0	2.0	2.0	1.0	NaN	NaN
chair	3.0	1.0	3.0	7.0	6.0	NaN	NaN	NaN
get	3.0	3.0	NaN	2.0	NaN	NaN	NaN	NaN
mattress	2.0	NaN	NaN	NaN	NaN	NaN	NaN	NaN
flight	2.0	NaN	3.0	2.0	NaN	NaN	NaN	NaN
slid	2.0	NaN	NaN	NaN	NaN	NaN	NaN	NaN
walking	2.0	1.0	4.0	3.0	3.0	1.0	1.0	NaN
getting	2.0	2.0	NaN	4.0	2.0	2.0	NaN	NaN
forward	2.0	NaN	2.0	2.0	NaN	NaN	NaN	NaN
walker	2.0	NaN	2.0	1.0	1.0	1.0	NaN	NaN
fall	2.0	9.0	7.0	8.0	10.0	3.0	NaN	NaN
backwards	2.0	NaN	4.0	NaN	1.0	NaN	NaN	NaN
got	2.0	1.0	2.0	2.0	1.0	NaN	NaN	NaN

Figure 6: Frequently occurring action-related words by age.