Unsupervised Wisdom – Final Report by SeaHawk

Key Takeaways

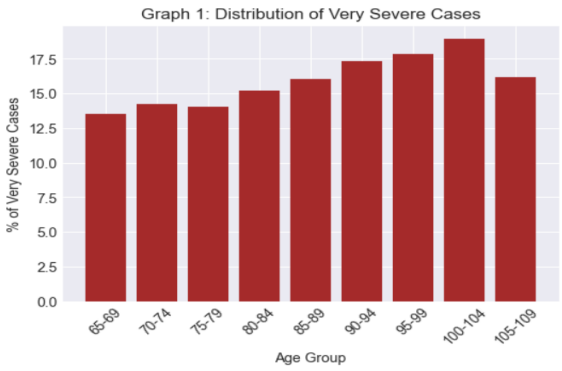
- The data analysis highlights a concerning trend among individuals aged 65 and above, revealing that they are at **a high risk of experiencing severe and very severe injuries**, particularly **fractures and internal injuries**, due to falls. These findings emphasize the vulnerability of older adults to significant physical harm from falls, with the **head and upper/lower trunk** being the most affected areas. To address this issue, it is crucial to prioritize preventive measures and interventions such as enhancing home safety, providing balance training, and ensuring regular health check-ups for the elderly. These actions are essential to reduce the likelihood of falls leading to severe injuries in this demographic.[
- The data indicates that certain activities, such as **ascending or descending stairs** and using **bathroom facilities**, pose a **higher risk for very severe falls** among the elderly. This insight underscores the importance of home safety modifications for older adults. Encouraging elderly individuals to adapt their living spaces by ***installing handrails on staircases***, ***adding non-slip mats in the bathroom***, and making bedroom exits more accessible can significantly reduce the risk of falls.

Data Insights from the Extractions

Following our custom pipeline, we have derived various attributes like severity of fall, action performed just before the fall and risk factors/reasons of fall associates with falls of elderly -

- **Severity**
  - We categorized fall severity based on various medical journals:
    - **"Very Severe":** Life-threatening with long-term effects
    - **"Severe":** Requires multiple days of hospitalization.
    - **"Moderate":** Needs a doctor's visit but no hospitalization.
    - **"Minor":** No hospitalization or doctor's visit required.

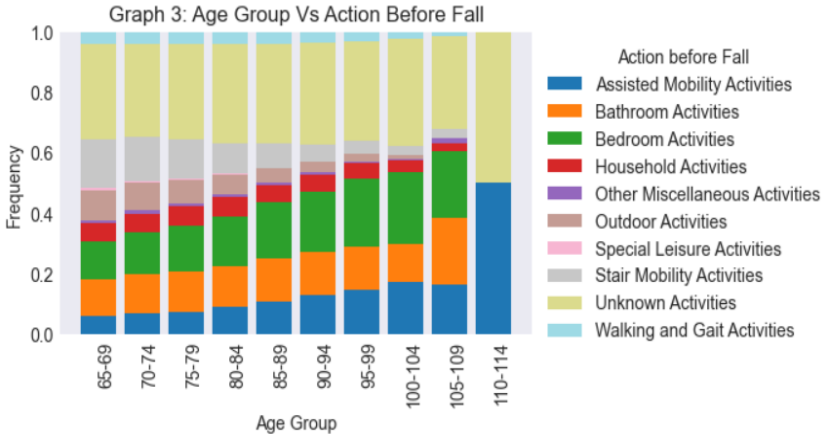
  - It was observed that the **percentage of "very severe" cases tends to increase with the age of the patients**. Specifically, individuals **aged 80 or above** are at a significantly higher risk of experiencing very severe falls. This insight calls for targeted interventions and policies that cater to the unique needs and vulnerabilities of the oldest segment of the elderly population.



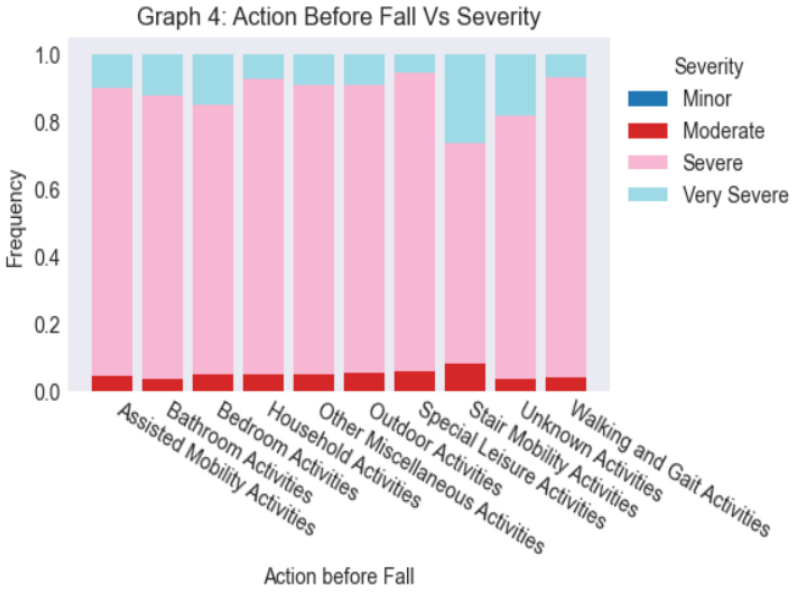
❖ **Action before fall**

➢ *Products attribute in the data was found to be strongly correlated with actions preceding a fall.* Hence, we used Products attribute as input to ChatGPT to create buckets for action before fall which are as follows -

- Assisted Mobility Activities, Walking and Gait Activities, Stair Mobility Activities, Bathroom Activities, Bedroom Activities, Household Activities, Outdoor Activities, Special Leisure Activities, and Other Miscellaneous Activities.



➢ There is a clear **correlation between age and the utilization of assisted mobility aids** or assistance, such as walkers or wheelchairs, which in turn leads to an increase in assisted mobility-related falls. This highlights the need for targeted policies and interventions that address the unique challenges and risks faced by older adults who rely on such assistance to reduce assisted mobility-related falls.



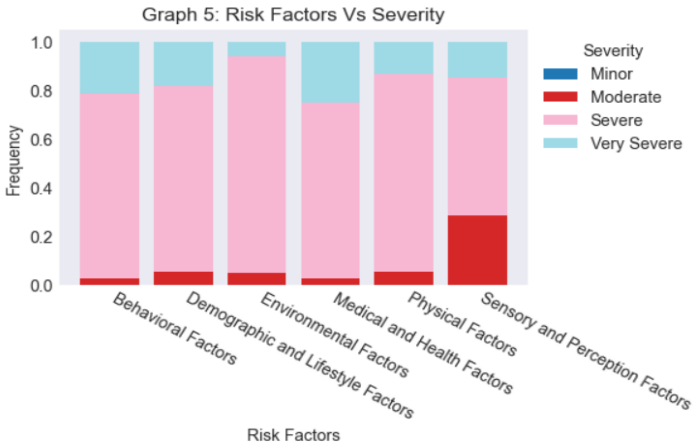
❖ **Reasons for Fall/ Risk Factors Associated with Falls**

➢ Comprehensive research was performed regarding risk factors associated with falls of elderly people from various medical findings and we collated them to create an exhaustive list using ChatGPT. Common risk factors associated with falls in elderly individuals include –

- **Medical and Health-Related Factors** such as chronic medical conditions (e.g., arthritis, stroke, Parkinson's, Alzheimer's/dementia), cognitive issues, and medication use.
- **Demographic and Lifestyle Factors** like older age, living alone, and reduced physical activity.
- **Sensory and Perception Factors** including impaired vision and hearing.
- **Environmental Factors** like home hazards and uneven surfaces.
- **Behavioral Factors** such as alcohol use with medication and bladder or bowel conditions.
- **Physical Factors** like lower body weakness, pain, and gait/balance problems.

These multifaceted risk factors collectively contribute to the increased susceptibility of elderly individuals to falls.

- The data reveals that **individuals with pre-existing medical/health conditions** are at a **higher risk of experiencing "very severe" falls**. This emphasizes the importance of managing underlying health issues in elderly patients and not just focusing on fall prevention. A holistic approach to elderly care should include **health assessments and chronic condition management**.



Data Sampling using Cluster Segmentation

A novel approach was used to sample data for segmentation. The main idea behind generating clusters was to **maximize the diversity between the falls incident data** such that the sample data is representative of the actual data.

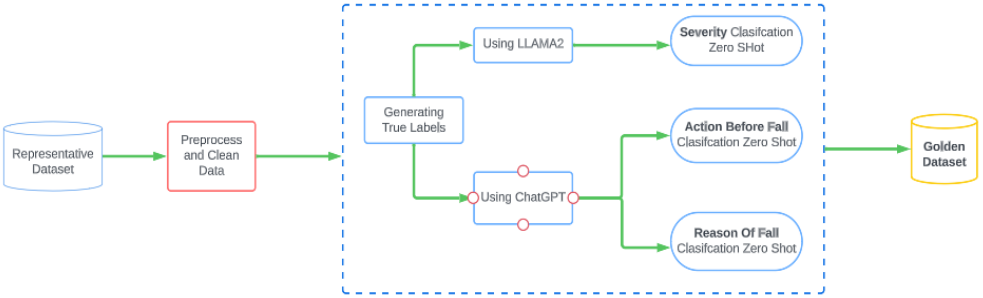
The **data was partitioned in 10,000 clusters** which is equal to the sample size of the representative dataset. In order to increase the diversity, the data point closest to the centroid of each cluster was chosen and added to the sample dataset hence making the sample data as diverse as possible.

It was observed that the representative data followed similar distribution as that of the actual Fall Incidents data. This is supported by the data analysis performed on the sample data as well as the actual data.

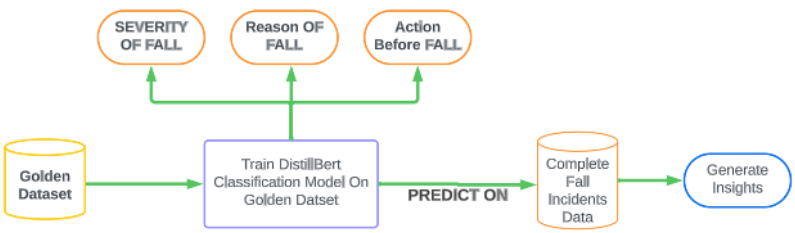
Fall Narratives Modelling – Severity, Action performed before Fall, Reason of Fall

As part of our modelling pipeline, the adopted approach is two folds –

- **Part 1:** Creation of Gold Standard Data – Various Large language models (LLMs) were employed to generate gold standard data (training data) for fine-tuning the classification model.



- **Part 2**: Predictions on complete dataset – The gold data created in step 1 was used to fine-tune a **DistilBERT model** (for classification), which was used to make predictions on the complete primary data.



References –

- LLAMA2 (Link to the Official Paper)
- BERTopic (Link to the Github Documentation)
- K-Means Clustering (Link to Research Paper)
- Falls in Older Persons: Risk Factors and Prevention (https://www.ncbi.nlm.nih.gov/books/NBK235613/)
- Intrinsic Risk Factors for Falls (https://www.ncbi.nlm.nih.gov/books/NBK235613/table/ttt00019/?report=objectonly)
- NHS Inform /Services – Causes of Fall (https://www.nhsinform.scot/healthy-living/preventing-falls/causes-of-falls)
- World Health Organization – Falls (https://www.who.int/news-room/fact-sheets/detail/falls)
- Centers for Disease Control and Prevention – Facts about Falls (https://www.cdc.gov/falls/facts.html)
- Risk Factors for Falls (https://www.aafp.org/pubs/afp/issues/2000/0401/p2159/jcr:content/root/aafp-article-primary-content-container/aafp_article_main_par/aafp_tables_content0.enlarge.html)
- DistilBert (https://huggingface.co/docs/transformers/model_doc/distilbert)