# Multi-Dimensional Interpretable Interaction Network (MDiiN) for **Modeling Aging Health and Mortality**

### Aging and Age-Related Diseases

A biological process during lifespan with accumulation of mutations and damages.

Accounts for The most critical risk factor associated with many diseases.

2/3 of deaths worldwide.

What is the biological mechanism of aging?

What We Don't Know

What connects aging to diseases?

Can we better prepare our elders?

### **MDiiN Architecture and Workflow**



**Experiment Results** 

### **Research Goal and Challenges**



## English Longitudinal Study of Aging (ELSA)



#### 3. Three-Dimensional Interaction Network

5. Gated Recurrent Unit

#### Follow-up From Entrance Wave



MDiiN can monitor people at risk for illness and mortality based on their health history. My model can identify and prevent them from a severe illness from COVID-19 and help us better respond to future threats.





#### **Project Significance**

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[11,12] [13,14]

[9,10]

MDiiN is the first three-dimensional interaction **network** to uncover high dimensional

**Future Work** 

The MDiiN model can be extended to a wide range of highdimensional health data, and ultimately improve our



MDiiN can estimate values for missing data for health records, preserving all cases and eliminating data bias.

interactions among health variables during the aging process.

MDiiN is one of the first complete SDE models that can predict an individual's health state and survival rate at any time.

MDiiN outperformed Elastic-Net in most metrics (C-Index = 0.9 vs 0.65 and Integrated Brier Score = 0.3 vs 0.6), and is comparable to the Elastic-Net for D-Calibration (p = 0.9 vs 1.0).

MDiiN is comparable to other high-dimensional models in prediction.

MDiiN's interpretability is visualized through a pairwise correlation network of the various health variables.

understanding of aging process and benefit public health.

Suppression of aging itself should delay or treat all age-related diseases, thus increasing healthy life span and maximal longevity.

Revealing the underlying causes of aging can help develop antiaging medicine to keep us stay healthy and biologically efficient.



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