

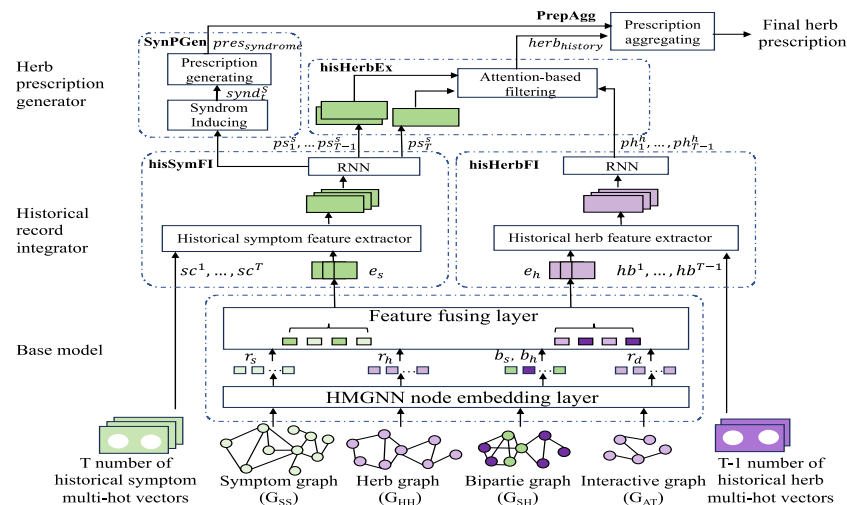
HyperRxGen: Historical-Contextualized Hyperbolic Framework for Herb Prescription Generation

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Frontiers of Computer Science, DOI: [10.1007/s11704-025-51628-x](https://doi.org/10.1007/s11704-025-51628-x)

Problems & Ideas

- Problems of current AI-TCM systems:
 - Static retrieval paradigm merely matches symptoms to fixed templates, lacking dynamic prescription generation.
 - Existing TCM knowledge representation approaches fail to model hierarchical herb networks, leading to embedding distortion problem.
 - Overlooking longitudinal clinical records, limiting personalization.
- Ideas: A hyperbolic prescription generation framework that considers both hierarchical herb interactions and longitudinal patient context.



The overall architecture of the proposed HyperRxGen framework. Bottom: The base model with Hyperbolic Multi-Graph Neural Network that encodes TCM knowledge into low-distortion embeddings. Middle: The historical record integrator that extracts and fuses features from a patient's past symptoms and prescriptions. Top: The prescription generator that synthesizes a final, personalized herb prescription by aggregating syndrome-based and history-based recommendations.

Main Contributions

- Contributions:
 - A contextual knowledge modeling method that uses Hyperbolic Multi-Graph Neural Network (HMGNN).
 - A novel TCM prescription generative problem definition and HMGNN-based generative methods for herb prescriptions, which combines adaptive historical weighting and geometric generation to reduce experiential bias and improve personalization.
 - Extensive experiments on two datasets show superior performance over baselines, proving effectiveness and efficiency.

Visiting	Symptom description	Model prediction	Golden prescription
1	恶风 (Aversion to wind and cold), 恶寒 (Aversion to cold), 头痛 (Headache), 面黄无泽 (Pale and lusterless complexion), 舌红 (Red tongue), 苔白滑厚腻 (White greasy coating), 关节疼痛 (Joint pain).	Fu Ling (Poria), Gan Cao (Licorice), Sheng Jiang (Fresh Ginger), Bai Zhu (Atractylodes Macrocephala), Gui Zhi (Cassia Twig), Fu Zi (Prepared Aconite Root), Bai Shao (White Peony Root)	Fu Ling (Poria), Zhi Gan Cao (Honey-fried Licorice), Sheng Jiang (Fresh Ginger), Bai Zhu (Atractylodes Macrocephala), Gui Zhi (Cassia Twig), Fu Zi (Prepared Aconite Root)
2	恶风 (Aversion to wind and cold), 恶寒 (Aversion to cold), 头痛 (Headache), 面黄无泽 (Pale and lusterless complexion), 舌红 (Red tongue), 苔白滑厚腻 (White greasy coating).	Fu Ling (Poria), Gan Cao (Licorice), Sheng Jiang (Fresh Ginger), Bai Zhu (Atractylodes Macrocephala), Gui Zhi (Cassia Twig), Fu Zi (Prepared Aconite Root), Bai Shao (White Peony Root), Chai Hu (Bupleurum Root)	Fu Ling (Poria), Zhi Gan Cao (Honey-fried Licorice), Sheng Jiang (Fresh Ginger), Bai Zhu (Atractylodes Macrocephala), Gui Zhi (Cassia Twig), Fu Zi (Prepared Aconite Root), Ma Huang (Ephedra), Xi Xin (Asarum)

A case study demonstrating HyperRxGen 's personalized prescription generation. The model, leveraging the patient 's first-visit record, innovatively recommends adding *Bai Shao* to form a novel yet clinically sound combination with *Gui Zhi*, aligning with TCM principles and achieving 85.7% similarity to the real second-visit prescription.