

# clinicalNLP: AI-Driven Clinical Documentation Intelligence

## Lovable Prompt Design & LLM Reasoning Control

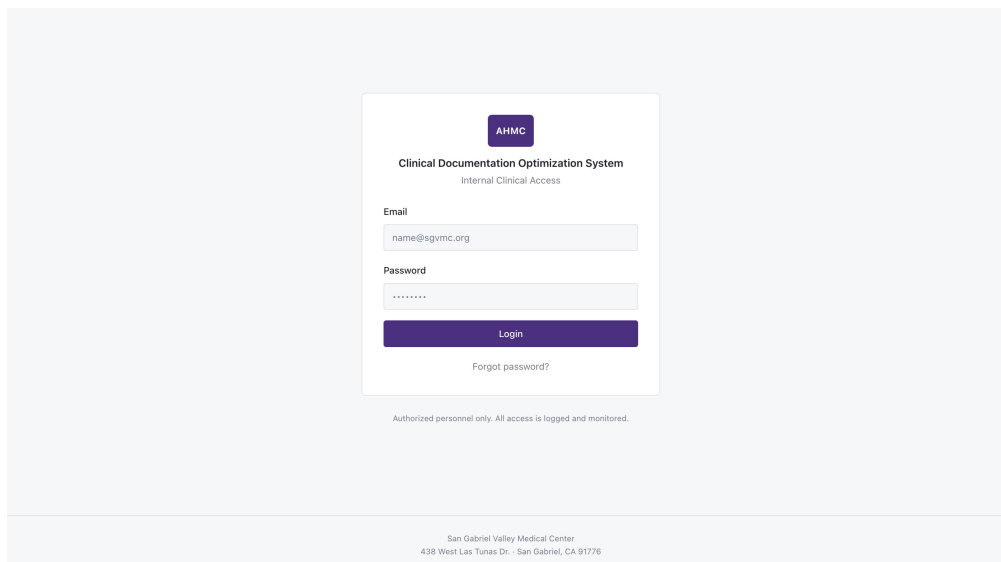
Candidate: Bingchen Li

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### 1 Product Interface Overview

#### 1.1 Fake Login

This interface simulates a secure login layer for demonstration purposes. To focus on system functionality and LLM reasoning behavior, authentication is intentionally simplified in the current prototype. Any credentials can be entered to access the demo environment.



#### 1.2 Clinical Document Input & Processing Trigger

This interface accepts raw physician documentation and optional guideline references.

**Users may:**

- Paste unstructured ER documentation into the input field
- Upload supporting guideline PDFs (e.g., MCG criteria)
- Trigger structured analysis via the "Analyze Documentation" action

**Upon submission, the system:**

- Extracts medical signals (vitals, labs, diagnoses)
- Applies severity stratification logic
- Sends structured inputs to the LLM reasoning layer

This design ensures controlled transformation from raw narrative text to structured clinical reasoning output.

AHMC

Clinical Documentation Optimization

San Gabriel Valley Medical Center

Logout

Clinical Documentation Optimization

AI-powered documentation enhancement.

DOCTOR RAW NOTES

questions appropriately here in the ER.  
Critical Care Time: 31 minutes  
Critical Care Note: Due to patient's critical care presentation to the ER, I was required to immediately assess the patient in order to stabilize their current care. I had to also reassess the patient multiple times during the entirety of the patient's stay in the ER. Due to the complexity of the patient's care, extended amount of time was spent on coordinating with higher level of care, patient and family discussion on patient's plan of care, and contacting appropriate physicians for consultation in this patient's care.  
The critical care time is excluding teaching and any procedural time dedicated to this patient.  
DIAGNOSTIC IMPRESSION:  
1. hypoxia, acute respiratory failure, pneumonia suspected, URI

7771 characters

MCG GUIDELINE PDF

MCG Pneumonia.pdf

PDF uploaded

X Remove

Analyze Documentation

San Gabriel Valley Medical Center

438 West Las Tunas Dr. · San Gabriel, CA 91776

### 1.3 Structured Output & Reporting

- a. Generates severity-aware revised documentation
- b. Maps clinical findings to guideline criteria
- c. Highlights missing or partial documentation

The system supports PDF export, Word export, print-ready formatting, and record saving, demonstrating production-oriented deployment readiness.

AHMC

Clinical Documentation Optimization

San Gabriel Valley Medical Center

Logout

Analysis Results

Documentation review completed — review suggestions below.

Export PDF

Export Word

Print

Save

REVISED DOCTOR NOTES

The patient is an 82-year-old male with a history of chronic illness, presenting to the emergency department with a chief complaint of cough and shortness of breath for one week. Per ER documentation, the patient's symptoms have progressed over the past week, prompting concern from the nursing home staff. The patient denies any underlying chest pain, fever, chills, abdominal pain, nausea, vomiting, or diarrhea. The patient's past medical history, past surgical history, and social history were reviewed with the patient and nursing documentation.

Per ER documentation, the patient's objective findings include an initial oxygen saturation of 90% on room air, which improved to 98% on 4L of supplemental oxygen. The patient's vital signs show a respiratory rate and oxygen saturation that required supplemental oxygen to maintain adequate oxygenation. Imaging findings, per ER documentation, reveal radiographic evidence of bilateral lower lobe infiltrates concerning for pneumonia. Laboratory findings, per ER documentation, include a white blood cell count of 10.10, which, although not significantly elevated, is considered in the context of the patient's overall clinical presentation.

Per ER documentation, the patient received emergency department management, including the initiation of intravenous antibiotics and supplemental oxygen. Blood cultures were also obtained. The decision to admit the patient was made due to the patient's clinical presentation, including hypoxia and suspected pneumonia, which required further evaluation and management. The patient's condition and response to treatment were closely monitored during the emergency department stay.

The patient's admission to the hospital is justified due to the presence of hypoxemia, as evidenced by an initial oxygen saturation of 90% on room air, and the suspicion of pneumonia, as supported by radiographic evidence of bilateral lower lobe infiltrates. Additionally, the patient's advanced age and chronic illness contribute to the need for inpatient-level care. The patient's condition, including the need for supplemental oxygen and intravenous antibiotics, warrants inpatient-level management.

MISSING CRITERIA ANALYSIS

Oxygen saturation

Partial

Evidence: SpO2: 90

Guideline: MCG suggests admission if SpO2 < 90%.

Action: Document oxygen saturation and need for supplemental oxygen.

Radiographic evidence of pneumonia

Met

Evidence: Imaging suggests pneumonia.

Guideline: MCG requires objective imaging confirmation.

Action: No additional action needed.

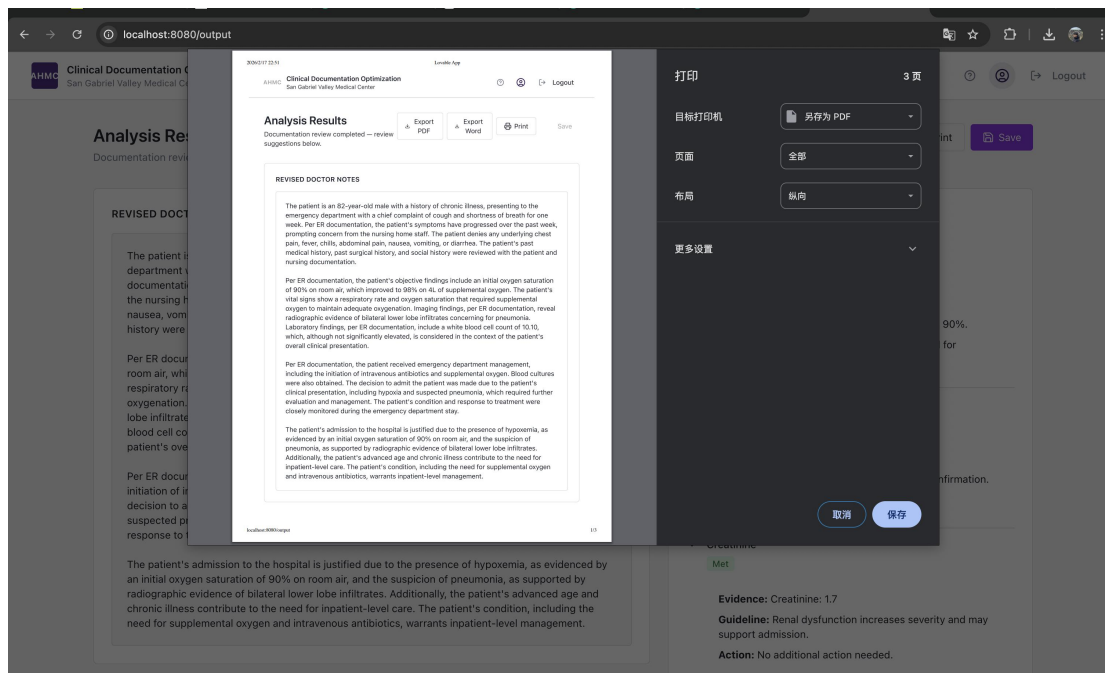
Creatinine

Met

Evidence: Creatinine: 1.7

Guideline: Renal dysfunction increases severity and may support admission.

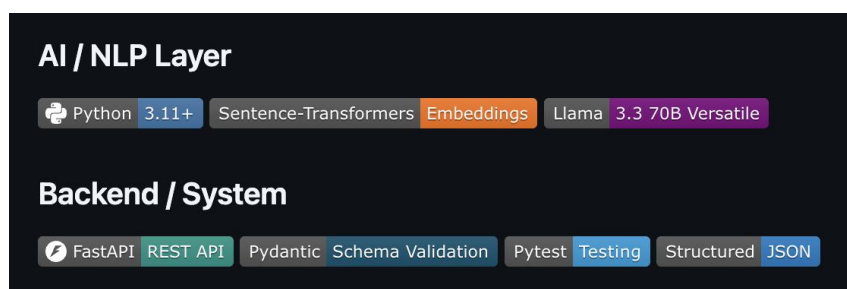
Action: No additional action needed.



## 2.System Architecture & Technical Design

### 2.1 Technical Stack Summary

The clinicalNLP is implemented in Python 3.11+ with a modular service-layer architecture. The AI layer combines embedding-based preprocessing (Sentence-Transformers) with controlled LLM reasoning using Llama-3.3-70B-Versatile. While the backend is built on FastAPI with Pydantic schema validation and structured JSON outputs. Automated testing is performed using pytest to ensure consistency and reliability.



### 2.2 System Architecture Overview

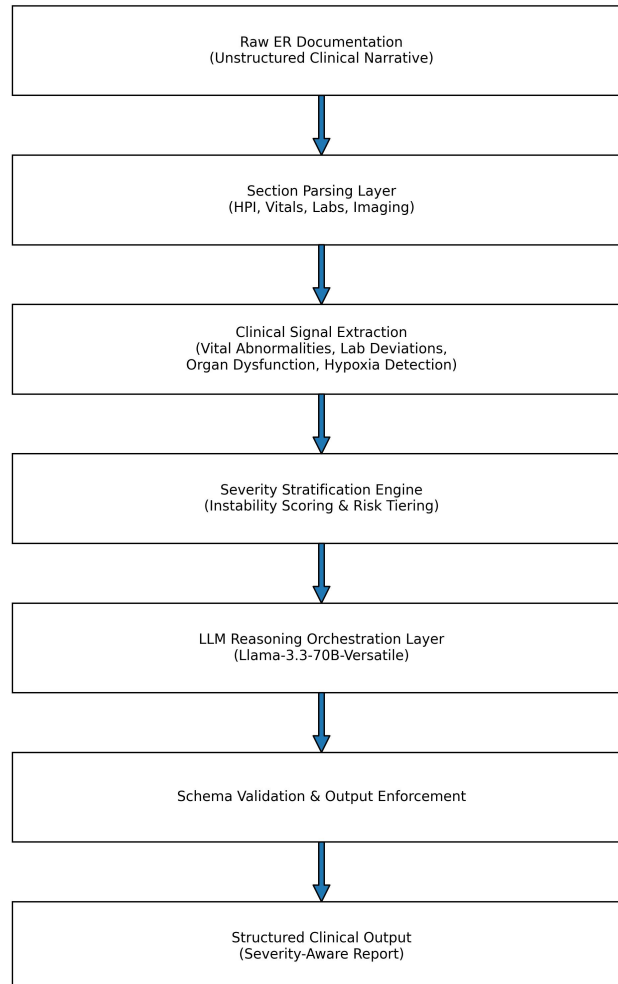
clinicalNLP follows a hybrid clinical NLP architecture that separates deterministic preprocessing from LLM reasoning.

#### Processing layers include:

- Section Parsing: Structured extraction of HPI, vitals, labs, and imaging
- Clinical Signal Extraction: Detection of abnormal findings and organ dysfunction markers
- Severity Engine – Instability stratification via predefined heuristics
- LLM Reasoning (Llama-3.3-70B-Versatile) – Structured admission-level synthesis

#### e.Schema Validation – Deterministic output enforcement

Generative reasoning is applied only after structured signal construction to ensure controlled and reproducible outputs.



### 3. AI-Assisted Lovable Prompt Architecture

The Lovable Prompt used in clinicalNLP was developed through an AI-assisted process as following:

#### Part I

Design a professional enterprise healthcare web application UI.

The system is called:

"Clinical Documentation Optimization System"

It is an internal hospital tool used by physicians and utilization review staff.

The design should be inspired by Anaheim Regional Medical Center's official branding:

Primary color: deep royal purple (#4B2E83 or similar)

Secondary: lighter purple accent

Background: very light gray or white

Text: dark charcoal

Style: clean, institutional, hospital-grade, not startup flashy

Avoid gradients, avoid neon colors.

The UI should feel:

- Secure
- Authoritative
- Clean
- Medical enterprise
- HIPAA-compliant system
- Internal hospital tool

Use modern spacing, soft shadows, rounded corners (subtle), and clear section divisions.

Create 3 Pages:

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PAGE 0 – Login Page (Fake Authentication Page)  
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Purpose: Entry portal for internal staff.

Layout:

Centered login card.

Hospital logo placeholder at top.

Title:

"Clinical Documentation Optimization System"

Subtitle:

Internal Access Only

Fields:

- Email
- Password
- Login button (primary purple)
- Small "Forgot password?" link

Below login box:

Small muted disclaimer:

"Authorized hospital personnel only. All access is logged."

Style:

Minimal.

Clean.

Professional.

White card with subtle shadow.

Purple header accent bar at top of page.

-----  
PAGE 1 – Input Interface  
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Title:

Clinical Documentation Optimization

Subtitle:

Align physician documentation with MCG admission criteria.

Two required input sections in card layout:

LEFT SIDE (Doctor Notes)

- Large multiline text area
- Label: "Doctor Raw Notes"
- Character counter
- Clean bordered box

RIGHT SIDE (MCG Upload)

- Drag-and-drop file upload area
- Label: "MCG Guideline PDF"
- File icon
- Show uploaded file name placeholder
- Upload status badge (Ready / Uploaded)

Below both sections:

Primary button (large purple button):

"Analyze Documentation"

Top navigation bar:

Left:

System logo placeholder

System name

Right:  
User profile circle  
Logout  
Help icon

---

## PAGE 2 – Output Interface

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Title:  
Analysis Results

Layout:

Two-column professional dashboard layout.

LEFT PANEL:

Revised Doctor Notes

- Editable formatted text area
- Highlighted inserted content (light purple background)
- Section header with small "Confidence Score" badge

RIGHT PANEL:

Missing Criteria List

Structured table with columns:

- Criteria
- Status (Met / Missing)
- Confidence %
- Evidence (expandable)
- Recommended Action

Status badges:

Green = Met

Red = Missing

Yellow = Partial

Each row expandable to show:

- Extracted evidence sentence
- Guideline reference

Top right corner:

Export button (PDF / Word)

Print

Save

Design Tone:

Clinical review tool

Structured

Audit-ready

Clear hierarchy

Readable tables

Ample spacing

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## GLOBAL DESIGN RULES

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Typography:

Professional sans-serif

Medium weight headings

Clear section hierarchy

Icons:

Minimal line icons

Medical-appropriate

Spacing:

Generous whitespace

8px grid system

No marketing banners.

No decorative illustrations.

This is a hospital internal productivity system.

Make it look like it belongs inside a real hospital intranet.

## **PartII**

Design a professional enterprise healthcare web application UI.

System Name:

Clinical Documentation Optimization System

This is an internal hospital clinical documentation review tool used by physicians and utilization management staff.

Branding Inspiration:

San Gabriel Valley Medical Center

Primary Color:

Deep royal purple (#4B2E83 or similar)

Secondary:

Soft lavender accent

Background:

Very light gray (#F7F8FA) or white

Text:

Dark charcoal

Style Direction:

- Institutional
- Hospital enterprise
- Authoritative
- Clean
- Secure
- HIPAA-aware
- Not startup-like
- No flashy gradients
- No bright colors
- No marketing visuals

Use:

Soft shadows

Subtle rounded corners

Clean card layout

Clear section hierarchy

Strong alignment

Professional spacing (8px grid)

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GLOBAL FOOTER (APPEARS ON ALL PAGES)

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At the bottom of every page include a thin, subtle divider line and a centered muted footer:

San Gabriel Valley Medical Center

438 West Las Tunas Dr.

San Gabriel, CA 91776

Use small, muted gray text.

Minimal.  
Professional.  
No decorative elements.

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## PAGE 0 – LOGIN PAGE (Fake Authentication)

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Purpose:  
Internal hospital access portal.

Layout:

Full-page clean background.  
Centered white login card with subtle shadow.

Top of card:  
Hospital logo placeholder  
System Name:  
Clinical Documentation Optimization System

Subtitle:  
Internal Clinical Access

Fields:  
- Email  
- Password  
- Login button (Primary purple, full width)

Below button:  
"Forgot password?" link

Under the card:  
Small muted disclaimer text:  
"Authorized personnel only. All access is logged and monitored."

Visual Feel:  
Secure.  
Institutional.  
Minimal.  
Enterprise healthcare.

---

## PAGE 1 – INPUT INTERFACE

---

Top Navigation Bar:

Left:

Hospital logo placeholder

System name

Right:

User avatar circle

Help icon

Logout button

Page Title:

Clinical Documentation Optimization

Subtitle:

Align physician documentation with MCG admission criteria.

Main Layout:

Two equal-width cards side-by-side.

LEFT CARD:

Title: Doctor Raw Notes

Large multiline text area

Character counter bottom-right

Clear border

Scrollable

RIGHT CARD:

Title: MCG Guideline PDF

Drag-and-drop upload zone

File icon

Upload status badge (Ready / Uploaded)

File name placeholder

Below both cards:

Large primary purple button:

Analyze Documentation

Professional spacing and alignment.

---

PAGE 2 – OUTPUT INTERFACE

-----  
Top Navigation (same as Page 1)

Page Title:  
Analysis Results

Two-column structured dashboard layout.

LEFT PANEL (60% width):

Card titled:  
Revised Doctor Notes

Editable formatted text area.

Inserted suggestions highlighted with light purple background.

Small badge near header:

Confidence Score: 92%

RIGHT PANEL (40% width):

Card titled:  
Missing Criteria Analysis

Structured table with columns:

- Criteria
- Status (Met / Missing / Partial)
- Confidence %
- Evidence (expandable row)
- Recommended Action

Status colors:

Green = Met

Red = Missing

Yellow = Partial

Expandable rows show:

- Extracted evidence sentence
- Guideline reference

Top-right action bar:

Export (PDF)

Export (Word)

Print

Save

Design Tone:  
Clinical audit tool.  
Structured.  
Readable.  
Clear hierarchy.  
High trust.

---

## TYPOGRAPHY

---

Professional sans-serif.  
Medium weight headings.  
Clear visual hierarchy.  
No decorative fonts.

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## IMPORTANT

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This should look like a real hospital intranet system used by clinical reviewers.  
Not a marketing website.  
Not a startup dashboard.  
Enterprise medical software.