Creating ShinyR Dashboards using AI

For Malaysian Healthcare Decision-making

Dr. Ahmad Hakiim Jamaluddin
PhD (Mathematics & Statistics), UNSW Sydney

School of Mathematics and Statistics, UNSW Sydney
UNSW Data Science Hub (uDASH)
Department of Mathematics and Statistics, UPM Serdang

NHTA Pre-conference Workshop
29 July 2025 | 2:00 PM - 5:00 PM | PICC Malaysia

1. Introduction

2. Shiny Fundamentals

3. LLM-Powered Development

4. Healthcare Dashboard Lab

5. Conclusion

Workshop Agenda

Agenda

- **2:00-2:15**: Introduction to Shiny & Healthcare Dashboards
- **2:15-2:45**: Shiny Fundamentals
- **2:45-3:15**: LLM-Powered Development (ChatGPT/Grok/Deepseek)
- **3:15-3:30**: Coffee Break
- **3:30-4:50**: Healthcare Dashboard Lab
- **4:50-5:00**: Q&A & Resources

Why Shiny for Healthcare?

Healthcare Applications

- Patient outcome tracking
- Resource allocation monitoring
- Epidemiological trend analysis
- Clinical trial reporting

Benefits

- Real-time data visualisation
- Interactive decision support
- Customisable for Malaysian healthcare needs

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Shiny App Anatomy

Core Components

- **UI (User Interface):** Controls layout, inputs (e.g., shinyWidgets dropdowns)
- **Server:** Handles data processing, reactivity
- **Reactivity:** Automatic UI updates with modular code (e.g., `moduleServer`)
- **Modularity:** Use reusable UI/server modules for scalability

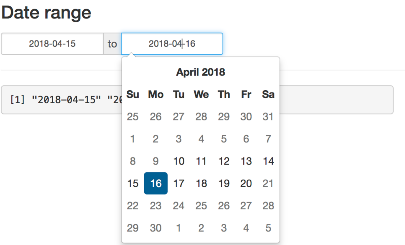
Healthcare-Ready Components

Inputs

- Date range selectors (e.g., shinyWidgets sliders)
- Patient group filters
- Clinical parameter sliders
- Facility selectors with input validation

Outputs

- Interactive epidemic curves (plotly/ggplot2)
- Patient outcome tables (DT)
- Resource utilisation charts
- Geographic heatmaps (leaflet)



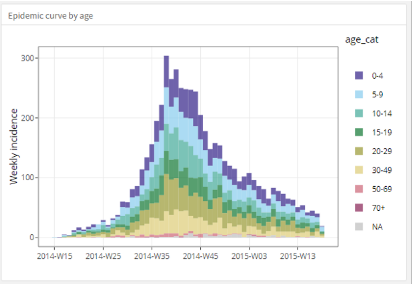
Date range

2018-04-15 to 2018-04-16

```
[1] "2018-04-15" "2
```

April 2018

Su	Mo	Tu	We	Th	Fr	Sa
25	26	27	28	29	30	31
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	1	2	3	4	5



Example dashboard: *Patient Registry System*

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LLM Workflow for Shiny

Workflow Steps

1. Define clear requirements (objectives, data, visualisations, UI)
2. Generate modular code with LLMs (e.g., ”ShinyR module for plotly bar chart”)
3. Optimise prompts with R/Shiny versions, libraries, error handling
4. Validate, debug, and enhance interactivity (e.g., shinyWidgets, leaflet)

Effective Prompt Engineering

Good Prompt Structure

"Create a ShinyR app (Shiny 1.8, R 4.4) using medicaldata::covid_testing:
- Sidebar with facility dropdown, date range input
- Plotly positivity rate trend chart
- DT table for patient demographics
- Add try-catch for missing data, input validation for positive numbers"

Key Elements

- Specify R/Shiny versions, libraries, dataset structure
- Define visualisations (e.g., plotly, leaflet)
- Include error handling, interactivity
- Use synthetic data for sensitive projects

Hands-on Time!

Steps

- Open RStudio and your preferred LLM (ChatGPT, Grok, Deepseek)
- Use prompt: "Create ShinyR app (Shiny 1.8) with NHANES data, plotly scatterplot of BMI vs. Height, age range slider, DT table, error handling for missing data."
- Copy, paste, and run the script in RStudio
- Compare outputs from different LLMs

Shiny App Code: Libraries and Data Preparation

```r
# Load required libraries
library(shiny)
library(NHANES)
library(plotly)
library(DT)
library(dplyr)

# Prepare NHANES data with error handling
data <- tryCatch({
  NHANES %>%
    select(Age, Height, BMI) %>%
    filter(complete.cases(.))  # Remove rows with missing values
}, error = function(e) {
  message(‘‘Error in data preparation: ‘‘, e$message)
  return(NULL)
})
```

Shiny App Code: UI Definition

```
# Define UI with modular structure
ui <- fluidPage(
  titlePanel(‘‘NHANES BMI vs Height Dashboard‘‘),
  sidebarLayout(
    sidebarPanel(
      sliderInput(‘‘ageRange‘‘,
                  ‘‘Select Age Range‘‘,
                  min = if (!is.null(data)) min(data$Age, na.rm = TRUE) else 0,
                  max = if (!is.null(data)) max(data$Age, na.rm = TRUE) else 100,
                  value = if (!is.null(data)) c(min(data$Age, na.rm = TRUE), max(data$Age, na.rm = TRUE))
                        else c(0, 100),
                  step = 1),
      # Input validation script
      tags$script(‘‘Shiny.addCustomMessageHandler(‘alert‘, function(message) {alert(message);});‘‘)
    ),
    mainPanel(
      plotlyOutput(‘‘scatterPlot‘‘),
      DTOutput(‘‘dataTable‘‘)
    )
  )
)
```

Shiny App Code: Server Logic and Execution

```
# Define server logic with error handling
server <- function(input, output, session) {
  # Reactive data filtering
  filteredData <- reactive({
    req(data)
    validate(need(input$ageRange[1] >= 0, ‘‘Age must be positive‘‘))
    tryCatch({
      data %>%
        filter(Age >= input$ageRange[1] & Age <= input$ageRange[2])
    }, error = function(e) {
      session$sendCustomMessage(‘‘alert‘‘, paste(‘‘Error in data filtering: ‘‘, e$message))
      return(data.frame())
    })
  })
  # Render Plotly scatterplot
  output$scatterPlot <- renderPlotly({
    plot_data <- filteredData()
    if (nrow(plot_data) == 0) {
      return(plot_ly() %>%
             layout(title = ‘‘No data available‘‘, xaxis = list(title = ‘‘Height (cm)‘‘), yaxis = list(title =
                  ‘‘BMI‘‘)))
    }
    tryCatch({
      plot_ly(plot_data, x = ~Height, y = ~BMI, color = ~Age,
              type = ‘‘scatter‘‘, mode = ‘‘markers‘‘,
              marker = list(size = 8, opacity = 0.6)) %>%
        layout(title = ‘‘BMI vs Height by Age‘‘,
               xaxis = list(title = ‘‘Height (cm)‘‘),
               yaxis = list(title = ‘‘BMI (kg/m^2)‘‘))
    }, error = function(e) {
      session$sendCustomMessage(‘‘alert‘‘, paste(‘‘Error in plot generation: ‘‘, e$message))
      return(plot_ly() %>%
               layout(title = ‘‘Error in plot‘‘, xaxis = list(title = ‘‘Height (cm)‘‘), yaxis = list(title = ‘‘
                    BMI‘‘)))
    })
  })
```

Shiny App Code: Server Logic and Execution (continued)

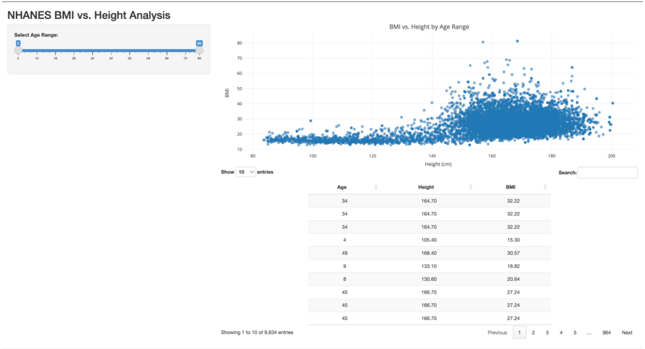
```
  # Render DT table
  output$dataTable <- renderDT({
    plot_data <- filteredData()
    if (nrow(plot_data) == 0) {
      return(datatable(data.frame(Message = ‘‘No data available‘‘)))
    }
    tryCatch({
      datatable(plot_data,
                options = list(pageLength = 10,
                              autoWidth = TRUE,
                              columnDefs = list(list(className = ‘dt-center‘, targets = ‘‘_all‘‘)),
                rownames = FALSE) %>%
        formatRound(columns = c(‘‘Height‘‘, ‘‘BMI‘‘), digits = 2)
    }, error = function(e) {
      session$sendCustomMessage(‘‘alert‘‘, paste(‘‘Error in table generation: ‘‘, e$message))
      return(datatable(data.frame(Message = ‘‘Error in table generation‘‘)))
    })
  })
}

# Run the application
shinyApp(ui = ui, server = server)
```

NHANES Dashboard Example

Interactive Dashboard

Visualises BMI vs. Height with an age range filter and interactive DT table.



NHANES BMI vs. Height Analysis

Select Age Range: 2 – 80

Show 10 entries

Search:

Age	Height	BMI
34	164.70	32.22
34	164.70	32.22
34	164.70	32.22
4	105.40	15.30
49	168.40	30.57
9	133.10	16.82
8	130.60	20.64
45	166.70	27.24
45	166.70	27.24
45	166.70	27.24

Showing 1 to 10 of 9,634 entries

Explore live dashboards: *Diabetes & Hypertension Insights*, *Malaysian News Hub*

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Lab Exercise: Diabetes Dashboard

Dataset and Requirements

Dataset: *PimaIndiansDiabetes* (via `mlbench` package)
Columns: `pregnant` (times pregnant), `glucose` (mg/dL), `pressure` (mm Hg), `triceps` (mm), `insulin` (mu U/ml), `mass` (BMI), `pedigree`, `age` (years), `diabetes` (pos, neg)
Requirements:

1. Age histogram (adjustable bins: 5–20, `ggplot2`)
2. Bar chart of patient count by diabetes status
3. Box plot of glucose levels by diabetes status
4. Scatter plot of glucose vs. BMI, colored by diabetes status
5. Filters: Diabetes status dropdown (All, pos, neg), age range slider (0–100)
6. Metrics: Total patients, average glucose, % diabetes positive

Lab Exercise: Diabetes Dashboard

LLM Prompt Template

“Create a ShinyR dashboard for the `PimaIndiansDiabetes` dataset (via `mlbench`):

- Sidebar with diabetes status dropdown (All, pos, neg), age range slider (0–100)
- Plots: age histogram (bins: 5–20), bar chart of patient count by diabetes status, box plot of glucose by diabetes status, glucose vs. BMI scatter plot coloured by diabetes status
- Metrics: total patients, average glucose, % diabetes positive
- Use `shiny`, `shinydashboard`, `ggplot2`, `dplyr`, `viridis`
- Handle missing or invalid data (e.g., NA or zero values) with error messages
- Save filtered dataset as `diabetes.csv`.”

Step-by-Step Implementation

Phase 1: Environment Setting

1. Set up account on Posit (online RStudio): `https://posit.cloud/`
2. Create a new project
3. Prepare the coding canvas

Phase 2: Dashboard Development

1. Specify the requirements for the dashboard
2. Save the final code as “app.R” (for hosting/publishing purposes)

Phase 3: Hosting on a Website

1. Set up account on shinyapps.io: `https://www.shinyapps.io/`
2. Create a token & copy the token
3. Publish it (by using the token on another Posit coding canvas)!

Please find a detailed guideline HERE.

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Key Takeaways

Summary

1. Shiny enables rapid, interactive healthcare dashboards
2. LLMs (ChatGPT, DeepSeek, or Grok) reduce coding barriers
3. Ensure security (local LLMs, synthetic data) and compliance
4. Stay updated with Shiny features, optimise, and test thoroughly

Resources

- **Shiny Basics**: https://shiny.posit.co/
- **Healthcare Datasets**:
  - NHANES: https://wwwn.cdc.gov/nchs/nhanes/
  - MIMIC: https://mimic.mit.edu/
  - medicaldata: https://higgi13425.github.io/medicaldata/
- **LLM Platforms**:
  - ChatGPT: https://chat.openai.com/
  - Grok: https://grok.com/
  - Deepseek: https://chat.deepseek.com/
- **Advanced References**:
  - EpiR Handbook: https://epirhandbook.com/en/new_pages/shiny_basics.html
  - ShinyR dashboards: https://tilburgsciencehub.com/examples
  - R packages: https://cran.r-project.org/web/views/

Questions are welcomed!