**PCA Plot (Fig2. Panel A)**

# Load necessary libraries

library(ggplot2)

library(ggfortify)

# Assuming 'data' is your dataset and 'group' is a factor column with "Control" and "Case"

pca\_res <- prcomp(data, scale. = TRUE)

# Plot PCA

ggplot() +

 geom\_point(aes(x = pca\_res$x[,1], y = pca\_res$x[,2], color = group), size = 3) +

 stat\_ellipse(aes(x = pca\_res$x[,1], y = pca\_res$x[,2], color = group), level = 0.95) +

 labs(x = paste("PC1 (", round(summary(pca\_res)$importance[2,1] \* 100, 2), "%)", sep=""),

 y = paste("PC2 (", round(summary(pca\_res)$importance[2,2] \* 100, 2), "%)", sep=""),

 title = "PCA Plot") +

 theme\_minimal()

**Volcano Plot (Fig2.Panel B)**

# Load necessary libraries

library(ggplot2)

# Assuming 'results' is a dataframe with 'log2FoldChange' and 'pvalue'

results$significant <- "Not Significant"

results$significant[results$pvalue < 0.05 & abs(results$log2FoldChange) > 1] <- "Significant"

ggplot(results, aes(x = log2FoldChange, y = -log10(pvalue), color = significant)) +

 geom\_point(alpha = 0.6, size = 2) +

 geom\_text(aes(label = ifelse(significant == "Significant", as.character(gene), '')),

 vjust = 1.5, hjust = 1.5, check\_overlap = TRUE) +

 geom\_vline(xintercept = c(-1, 1), linetype = "dashed") +

 geom\_hline(yintercept = -log10(0.05), linetype = "dashed") +

 scale\_color\_manual(values = c("grey", "red", "blue")) +

 theme\_minimal() +

 labs(x = "log2(Fold Change)", y = "-log10(p-value)", title = "Volcano Plot")

**Heatmap (Fig2.Panel C)**

# Load necessary libraries

library(pheatmap)

# Assuming 'data\_matrix' is the data matrix with rows as genes and columns as samples

# 'annotation' is a dataframe indicating the sample groups

# Plot heatmap

pheatmap(data\_matrix,

 annotation\_col = annotation,

 scale = "row",

 clustering\_method = "complete",

 show\_colnames = TRUE,

 show\_rownames = TRUE,

 color = colorRampPalette(c("blue", "white", "red"))(50))

**Violin Plot with Multiple Genes (Fig3，Fig8)**

# Load necessary libraries

library(ggplot2)

# Assuming 'data' is a dataframe with columns: 'Gene', 'Expression', and 'Group'

# 'Gene' is a factor of gene names, 'Expression' is the expression level, and 'Group' is the factor indicating 'Case' or 'Control'

# Panel A and Panel B can be created similarly, with different subsets of 'Gene'

# Example for Panel A

ggplot(data, aes(x = Gene, y = Expression, fill = Group)) +

 geom\_violin(trim = FALSE) +

**Correlation Heatmap with Significance (Fig4.Panel A)**

# Load necessary libraries

library(corrplot)

# Assuming 'cor\_matrix' is the correlation matrix, and 'p\_matrix' is the matrix of p-values

# Create a function to get the significance stars

cor.mtest <- function(mat, ...) {

 mat <- as.matrix(mat)

 n <- ncol(mat)

 p.mat <- matrix(NA, n, n)

 diag(p.mat) <- 0

 for (i in 1:(n - 1)) {

 for (j in (i + 1):n) {

 tmp <- cor.test(mat[, i], mat[, j], ...)

 p.mat[i, j] <- p.mat[j, i] <- tmp$p.value

 }

 }

 colnames(p.mat) <- rownames(p.mat) <- colnames(mat)

 p.mat

}

# Calculate the p-values matrix if not available

p\_matrix <- cor.mtest(cor\_matrix)

# Plot

corrplot(cor\_matrix, method = "circle", type = "lower",

 p.mat = p\_matrix, sig.level = 0.05, insig = "blank",

 tl.col = "black", tl.srt = 45,

 col = colorRampPalette(c("blue", "white", "red"))(200))

geom\_boxplot(width = 0.1, position = position\_dodge(0.9), color = "black", outlier.shape = NA) +

 stat\_summary(fun = median, geom = "point", shape = 18, size = 2, color = "black", position = position\_dodge(0.9)) +

 scale\_fill\_manual(values = c("red", "blue")) +

 labs(x = "", y = "Gene Expression", title = "Panel A") +

 theme\_minimal() +

 theme(axis.text.x = element\_text(angle = 45, hjust = 1))

# Example for Panel B

ggplot(data\_b, aes(x = Gene, y = Expression, fill = Group)) +

 geom\_violin(trim = FALSE) +

 geom\_boxplot(width = 0.1, position = position\_dodge(0.9), color = "black", outlier.shape = NA) +

 stat\_summary(fun = median, geom = "point", shape = 18, size = 2, color = "black", position = position\_dodge(0.9)) +

 scale\_fill\_manual(values = c("red", "blue")) +

 labs(x = "", y = "Gene Expression", title = "Panel B") +

 theme\_minimal() +

 theme(axis.text.x = element\_text(angle = 45, hjust = 1))

**Detailed Correlation Matrix with Coefficients (Fig4.Panel B)**

# Load necessary libraries

library(ggcorrplot)

# Assuming 'cor\_matrix' is the correlation matrix and 'p\_matrix' contains the p-values

# Convert p-values to significance stars

stars <- ifelse(p\_matrix < 0.001, "\*\*\*",

 ifelse(p\_matrix < 0.01, "\*\*",

 ifelse(p\_matrix < 0.05, "\*", "")))

# Combine the correlation coefficients and significance stars

cor\_labels <- round(cor\_matrix, 2)

cor\_labels <- paste0(cor\_labels, stars)

# Plot

ggcorrplot(cor\_matrix,

 method = "square",

 type = "lower",

 lab = TRUE,

 lab\_col = "black",

 lab\_size = 3,

 show.legend = TRUE,

 title = "Correlation Matrix",

 legend.title = "Correlation Coefficient",

 ggtheme = theme\_minimal(),

 colors = c("blue", "white", "red"))

**Enrichment Dot Plot (Fig5. Panel A and B)**

# Load necessary libraries

library(ggplot2)

library(clusterProfiler)

library(enrichplot)

# Assuming 'enrichment\_result' is an enrichment result object from clusterProfiler (e.g., from enrichGO or enrichKEGG)

# Panel A

dotplot(enrichment\_result, showCategory = 20, split = "ONTOLOGY",

 color = "p.adjust", size = "Count") +

 scale\_color\_gradient(low = "blue", high = "red") +

 theme\_minimal() +

 labs(title = "Enrichment Dot Plot (Panel A)")

# Panel B (Assuming you want to split by different categories like BP, CC, MF)

dotplot(enrichment\_result, showCategory = 10, split = "ONTOLOGY",

 color = "p.adjust", size = "Count") +

 scale\_color\_gradient(low = "blue", high = "red") +

 facet\_grid(ONTOLOGY ~ ., scales = "free") +

 theme\_minimal() +

 labs(title = "Enrichment Dot Plot (Panel B)")

**Enrichment Network Plot (Fig5. Panel C)**

# Load necessary libraries

library(clusterProfiler)

library(enrichplot)

# Assuming 'enrichment\_result' is an enrichment result object

# Plot the enrichment network

cnetplot(enrichment\_result, showCategory = 10,

 foldChange = geneList, # Replace with your gene list with fold changes

 node\_label = "all") +

 theme\_minimal() +

 labs(title = "Enrichment Network Plot (Panel C)")

**Circular Chord Diagram (Fig6. Panels A and B)**

# Load necessary libraries

library(circlize)

# Example data: Replace this with your actual data

# Assuming `pathways\_genes` is a data frame with two columns:

# `Pathway` and `Gene`. Each row indicates a connection between a gene and a pathway.

# Example for Panel A

genes <- c("NRG1", "BAG3", "CAPN2", "ITGA6", "EGFR", "ARSB", "NAF1", "SIRT1", "CHMP2B", "EIF2AK3", "MAP1LC3B", "GOPC", "CLN3", "ATG3", "ATF6")

pathways <- c("Protein processing in endoplasmic reticulum", "Alzheimer disease", "Focal adhesion",

 "EGFR tyrosine kinase inhibitor resistance", "ErbB signaling pathway", "Lysosome",

 "FoxO signaling pathway", "Apoptosis", "Autophagy - animal", "Hepatitis C",

 "Cellular senescence", "Necroptosis", "Glycosaminoglycan degradation",

 "Regulation of actin cytoskeleton", "Autophagy - other")

# Prepare the data in a format suitable for circlize

# Example linkages between genes and pathways (fill in with actual data)

df <- data.frame(

 from = sample(genes, 30, replace = TRUE),

 to = sample(pathways, 30, replace = TRUE)

)

# Assign colors to the pathways

pathway\_colors <- rainbow(length(unique(df$to)))

# Plot the chord diagram

chordDiagram(df, grid.col = c(setNames(pathway\_colors, unique(df$to))))

# Add legend for pathways

legend("topright", legend = unique(df$to), fill = pathway\_colors, title = "KEGG Pathways")

# Repeat the same for Panel B with different data