

HW2

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0.1 Data information

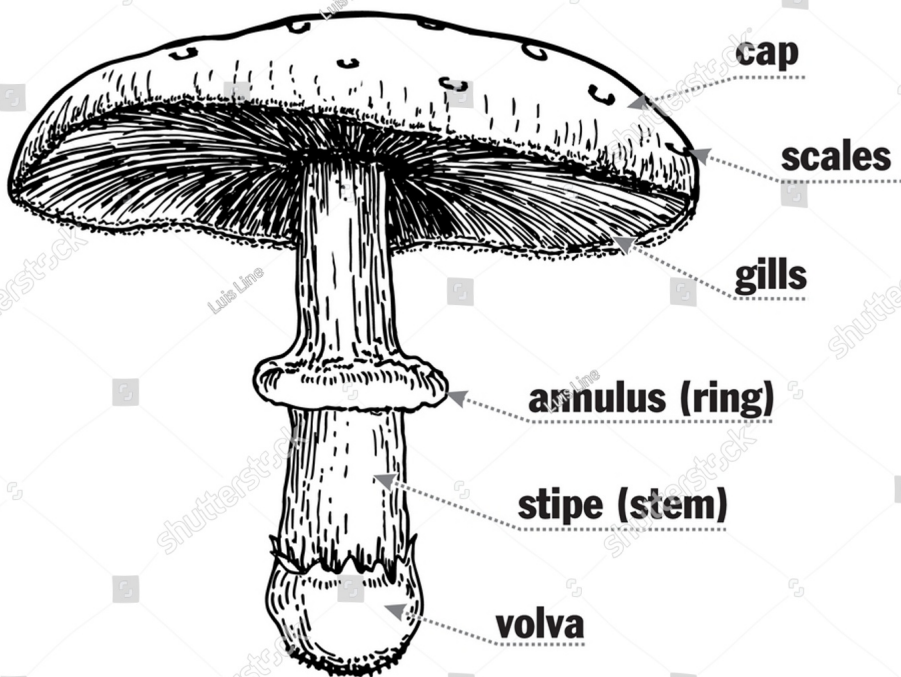
The data originates from Patrick Hardin' s book (1999) and was further processed using Python scripts from a public repository. The dataset was manually refined to ensure accuracy, making it suitable for classification and pattern analysis in mycology research.

This dataset contains 173 mushroom species, classified as edible or poisonous. It includes 20 variables, with 17 categorical and 3 numerical features describing mushroom characteristics such as cap shape, color, habitat, and spore print.

| Variable | Type | Annotation |
|-------------------|-------------|---|
| family | Categorical | Mushroom family name |
| name | Categorical | Mushroom variety name |
| class | Binary | Edible (e) / Poisonous (p) |
| cap-diameter | Continuous | Minimum value, maximum value, or average value (cm) |
| cap-shape | Categorical | bell (b), conical (c), convex (x), flat (f), sunken (s), spherical (p), others (o) |
| cap-surface | Categorical | fibrous (i), grooves (g), scaly (y), smooth (s), shiny (h), leathery (l), silky (k), sticky (t), wrinkled (w), fleshy (e) |
| cap-color | Categorical | brown (n), buff (b), gray (g), green (r), pink (p), purple (u), red (e), white (w), yellow (y), blue (l), orange (o), black (k) |
| does-bruise-bleed | Categorical | bruises-or-bleeding (t), no (f) |
| gill-attachment | Categorical | adnate (a), adnexed (x), decurrent (d), free (e), sinuate (s), pores (p), none (f), unknown (?) |
| gill-spacing | Categorical | close (c), distant (d), none (f) |
| gill-color | Categorical | Same as cap-color + none (f) |

| | | |
|-------------------|-------------|--|
| stem-height | Continuous | Minimum value, maximum value, or average value (cm) |
| stem-width | Continuous | Minimum value, maximum value, or average value (mm) |
| stem-root | Categorical | bulbous (b), swollen (s), club (c), cup (u), equal (e), rhizomorphs (z), rooted (r) |
| stem-surface | Categorical | Same as cap-surface + none (f) |
| stem-color | Categorical | Same as cap-color + none (f) |
| veil-type | Categorical | partial (p), universal (u) |
| veil-color | Categorical | Same as cap-color + none (f) |
| has-ring | Categorical | ring (t), none (f) |
| ring-type | Categorical | cobwebby (c), evanescent (e), flaring (r), grooved (g), large (l), pendant (p), sheathing (s), zone (z), scaly (y), movable (m), none (f), unknown (?) |
| spore-print-color | Categorical | Same as cap-color |
| habitat | Categorical | grasses (g), leaves (l), meadows (m), paths (p), heaths (h), urban (u), waste (w), woods (d) |
| season | Categorical | spring (s), summer (u), autumn (a), winter (w) |

Mature mushroom



0.2 Data pre-processing

To improve dataset readability and facilitate the observation of relationships between class and various characteristics, the following variables have been processed and structured accordingly:

- Cap
 - cap.diameter.min – Minimum cap diameter (cm).
 - cap.diameter.max – Maximum cap diameter (cm).
 - cap.diameter.avg – Observed average cap diameter (cm), if available.
 - cap.diameter.imputed – Estimated average cap diameter (cm), calculated as $(\min + \max)/2$ if 'cap.diameter.avg' is missing.
 - cap.shape.X – One-hot encoded columns for each cap shape category.
 - cap.surface.X – One-hot encoded columns for each cap surface type.
 - cap.color.group – Categorized cap colors into:
 - * dark: brown ('n '), black ('k '), gray ('g ').
 - * light: buff ('b '), white ('w '), yellow ('y ').
 - * warm: red ('e '), orange ('o '), pink ('p ').
 - * cool: green ('r '), purple ('u '), blue ('l ').
 - * other: includes missing values ('NA ') and none ('f ').
- Gill
 - gill.attachment.X – One-hot encoded columns for each gill attachment type.
 - gill.color.group – Categorized gill colors, see [cap.color.group](#).
- Stem
 - stem.height.min, stem.height.max, stem.height.avg, stem.height.imputed – Same as [cap.diameter.min](#), but for stem height (cm).
 - stem.width.min, stem.width.max, stem.width.avg, stem.width.imputed – Same as [cap.diameter.min](#), but for stem width (mm).
 - stem.surface.X – One-hot encoded columns for each stem surface type.
 - stem.color.group – Categorized stem colors, see [cap.color.group](#).
- Other
 - ring.type.X – One-hot encoded columns for each ring type.
 - spore.print.color.group – Categorized spore print colors, see [cap.color.group](#).
 - veil.color.group – Categorized veil colors, see [cap.color.group](#).
 - habitat.X – One-hot encoded columns for each habitat type.
 - season.X – One-hot encoded columns for each season type.

```
library(dplyr)
library(Hmisc)
library(tidyr)
library(stringr)

# Read original data
```

```

file_path <- "mushroom.txt" # Replace with your file name
lines <- readLines(file_path)

# Process column names
columns <- unlist(strsplit(lines[1], ";"))

# Process data within `[ ]` to ensure they're treated as single units
process_line <- function(line) {
  # Use regex to preserve content within `[ ]` to avoid splitting by `;`
  line <- gsub("\\[[^\\]]+\\]", "\\1", line)

  # Split by `;`
  split_line <- unlist(strsplit(line, ";"))

  split_line[split_line == ""] <- NA

  return(split_line)
}

# Process all data
data_list <- lapply(lines[-1], process_line)

# Convert to DataFrame
df <- as.data.frame(do.call(rbind, data_list), stringsAsFactors = FALSE)

# Set column names
colnames(df) <- columns

df<-read.csv("df.csv")
df <- df %>% rename(season = `season.....`)

df <- df %>%
  mutate(across(-c(X, cap.diameter, stem.height, stem.width), as.factor))

df <- df %>% select(-X)

df$class<-ifelse(df$class=="e", "Edible", "Poisonous")
df <- df %>%
  mutate(cap.diameter.clean = gsub("\\[[|\\]]", "", as.character(cap.diameter))) %>%
  mutate(value_count = sapply(strsplit(cap.diameter.clean, "\\s+", length)) %>%
    separate(cap.diameter.clean, into = c("cap.diameter.min", "cap.diameter.max"), sep = "\\s+", fill = "right"))
  mutate(
    cap.diameter.avg = ifelse(value_count == 1, cap.diameter.min, NA),
    cap.diameter.min = ifelse(value_count == 2, cap.diameter.min, NA),
    cap.diameter.max = ifelse(value_count == 2, cap.diameter.max, NA)
  ) %>%
  select(-value_count)

df <- df %>%
  mutate(stem.height.clean = gsub("\\[[|\\]]", "", as.character(stem.height))) %>%
  mutate(stem.value_count = sapply(strsplit(stem.height.clean, "\\s+", length)) %>%
    separate(stem.height.clean, into = c("stem.height.min", "stem.height.max"), sep = "\\s+", fill = "right"))
  mutate(
    stem.height.avg = ifelse(stem.value_count == 1, stem.height.min, NA),

```

```

    stem.height.min = ifelse(stem.value_count == 2, stem.height.min, NA),
    stem.height.max = ifelse(stem.value_count == 2, stem.height.max, NA)
  ) %>%
  select(-stem.value_count)

df <- df %>%
  mutate(stem.width.clean = gsub("\\[|\\]", "", as.character(stem.width))) %>%
  mutate(stem.width.value_count = sapply(strsplit(stem.width.clean, "\\s+"), length)) %>%
  separate(stem.width.clean, into = c("stem.width.min", "stem.width.max"), sep = "\\s+", fill = "right")
  mutate(
    stem.width.avg = ifelse(stem.width.value_count == 1, stem.width.min, NA),
    stem.width.min = ifelse(stem.width.value_count == 2, stem.width.min, NA),
    stem.width.max = ifelse(stem.width.value_count == 2, stem.width.max, NA)
  ) %>%
  select(-stem.width.value_count)

df <- df %>%
  mutate(across(c(cap.diameter.min, cap.diameter.max, cap.diameter.avg,
    stem.height.min, stem.height.max, stem.height.avg,
    stem.width.min, stem.width.max, stem.width.avg),
    ~ na_if(., 0)))

df <- df %>%
  mutate(across(c(cap.diameter.min, cap.diameter.max, cap.diameter.avg,
    stem.height.min, stem.height.max, stem.height.avg,
    stem.width.min, stem.width.max, stem.width.avg),
    ~ as.numeric(as.character(.)))) %>%

  mutate(
    cap.diameter.imputed = ifelse(!is.na(cap.diameter.avg), cap.diameter.avg, (cap.diameter.min + cap.diameter.max) / 2),
    stem.height.imputed = ifelse(!is.na(stem.height.avg), stem.height.avg, (stem.height.min + stem.height.max) / 2),
    stem.width.imputed = ifelse(!is.na(stem.width.avg), stem.width.avg, (stem.width.min + stem.width.max) / 2)
  )

df <- df %>%
  # Clean variables by removing `[`, `]`, and `\t`
  mutate(
    cap.shape.clean = str_replace_all(cap.shape, "[\\[\\]\\t]", ""),
    cap.surface.clean = str_replace_all(Cap.surface, "[\\[\\]\\t]", ""),
    stem.surface.clean = str_replace_all(stem.surface, "[\\[\\]\\t]", ""),
    ring.type.clean = str_replace_all(ring.type, "[\\[\\]\\t]", ""),
    habitat.clean = str_replace_all(habitat, "[\\[\\]\\t]", ""),
    season.clean = str_replace_all(season, "[\\[\\]\\t]", "")
  ) %>%

  # One-Hot Encoding for cap.shape
  separate_rows(cap.shape.clean, sep = " ") %>%
  mutate(value = 1) %>%
  pivot_wider(names_from = cap.shape.clean, values_from = value, values_fill = list(value = 0), names_prefix = "cap.shape.")
  mutate(across(starts_with("cap.shape."), as.factor)) %>%

  # One-Hot Encoding for cap.surface

```

```

separate_rows(cap.surface.clean, sep = " ") %>%
mutate(value = 1) %>%
pivot_wider(names_from = cap.surface.clean, values_from = value, values_fill = list(value = 0), names_prefix = "cap.surface.",
mutate(across(starts_with("cap.surface."), as.factor)) %>%

# One-Hot Encoding for stem.surface
separate_rows(stem.surface.clean, sep = " ") %>%
mutate(value = 1) %>%
pivot_wider(names_from = stem.surface.clean, values_from = value, values_fill = list(value = 0), names_prefix = "stem.surface.",
mutate(across(starts_with("stem.surface."), as.factor)) %>%

# One-Hot Encoding for ring.type
separate_rows(ring.type.clean, sep = " ") %>%
mutate(value = 1) %>%
pivot_wider(names_from = ring.type.clean, values_from = value, values_fill = list(value = 0), names_prefix = "ring.type.",
mutate(across(starts_with("ring.type."), as.factor)) %>%

# One-Hot Encoding for habitat
separate_rows(habitat.clean, sep = " ") %>%
mutate(value = 1) %>%
pivot_wider(names_from = habitat.clean, values_from = value, values_fill = list(value = 0), names_prefix = "habitat.",
mutate(across(starts_with("habitat."), as.factor)) %>%

# One-Hot Encoding for season
separate_rows(season.clean, sep = " ") %>%
mutate(value = 1) %>%
pivot_wider(names_from = season.clean, values_from = value, values_fill = list(value = 0), names_prefix = "season.",
mutate(across(starts_with("season."), as.factor))

library(forcats)

df <- df %>%
# Clean color-related variables
mutate(
  cap.color.clean = str_replace_all(cap.color, "[\\[\\]\\\\t]", ""),
  gill.color.clean = str_replace_all(gill.color, "[\\[\\]\\\\t]", ""),
  spore.print.color.clean = str_replace_all(Spore.print.color, "[\\[\\]\\\\t]", ""),
  stem.color.clean = str_replace_all(stem.color, "[\\[\\]\\\\t]", ""),
  veil.color.clean = str_replace_all(veil.color, "[\\[\\]\\\\t]", "")
) %>%

# Group colors into meaningful categories
mutate(across(c(cap.color.clean, gill.color.clean, spore.print.color.clean,
  stem.color.clean, veil.color.clean),
  ~ case_when(
    . %in% c("n", "k", "g") ~ "dark",
    . %in% c("b", "w", "y") ~ "light",
    . %in% c("e", "o", "p") ~ "warm",
    . %in% c("r", "u", "l") ~ "cool",
    TRUE ~ "other"
  ), .names = "{.col}.group")) %>%

```

```
# Convert to factor and reorder "other" to the last level
mutate(across(ends_with(".group"), ~ fct_relevel(as.factor(.), "other", after = Inf)))

df.a<-df %>%
  select(-matches("\\.clean$|\\.NA$"))
```

0.3 Data description

```
latex(describe(df.a), descript = "Descriptive Statistics (orginal)",
      file = '', caption.placement = "top")
```

| 86 Variables | | df.a | 173 Observations |
|--------------|-----------------------|--------------------------|-------------------------|
| family | | | |
| n | missing | distinct | |
| 173 | 0 | 23 | |
| lowest : | Amanita Family | Bolbitius Family | Bolete Family |
| highest: | Russula Family | Saddle-Cup Family | Stropharia Family |
| | | Bracket Fungi | Tricholoma Family |
| | | Chanterelle Family | Wax Gill Family |
| name | | | |
| n | missing | distinct | |
| 173 | 0 | 173 | |
| lowest : | Amethyst Deceiver | Aniseed Funnel Cap | Apricot Fungus |
| highest: | Yellow-gilled Russula | Yellow-staining Mushroom | Yellow-stemmed Bell Cap |
| | | Bare-toothed Russula | Bay Bolete |
| | | Yellow Swamp Russula | Yellow Wax cap |
| class | | | |
| n | missing | distinct | |
| 173 | 0 | 2 | |
| Value | Edible | Poisonous | |
| Frequency | 77 | 96 | |
| Proportion | 0.445 | 0.555 | |
| cap.diameter | | | |
| n | missing | distinct | |
| 173 | 0 | 51 | |
| lowest : | [0.4 1] | [0.5 1.5] | [0.5 1] |
| highest: | [8 14] | [8 15] | [8 20] |
| | | [0.7 1.3] | [1 1.5] |
| | | [8 25] | [8 30] |
| cap.shape | | | |
| n | missing | distinct | |
| 173 | 0 | 27 | |
| lowest : | [b f s] | [b f] | [b x f] |
| highest: | [x f] | [x o] | [x p] |
| | | | [x s] |
| | | | [x] |

Cap.surface

n missing distinct
133 40 40

lowest : [d e y i] [d k s] [d k] [d s] [d]
highest: [t] [w t] [w] [y s] [y]

cap.color

n missing distinct
173 0 67

lowest : [b p e y] [b u] [b] [e n p w] [e n y]
highest: [y n] [y o g n r] [y o r n] [y o] [y]

does.bruise.or.bleed

n missing distinct
173 0 2

Value [f] [t]
Frequency 143 30
Proportion 0.827 0.173

gill.attachment

n missing distinct
145 28 8

Value [a\t d] [a] [d] [e] [f] [p] [s] [x]
Frequency 8 32 25 16 10 17 16 21
Proportion 0.055 0.221 0.172 0.110 0.069 0.117 0.110 0.145

gill.spacing

n missing distinct
102 71 3

Value [c] [d] [f]
Frequency 70 22 10
Proportion 0.686 0.216 0.098

gill.color

n missing distinct
173 0 59

lowest : [b p w] [b u] [b] [e] [f]
highest: [y o e] [y r k] [y r] [y w] [y]

stem.height

n missing distinct
173 0 46

lowest : [0] [1 2] [1 3] [10 12] [10 15], highest: [8 12] [8 15] [8 20] [8 25] [8 30]

stem.width

n missing distinct
173 0 48

lowest : [0.5 1] [0] [1 2] [1 3] [1], highest: [7 15] [8 12] [8 15] [8 18] [8 20]

stem.root

| n | missing | distinct |
|----|---------|----------|
| 27 | 146 | 5 |

| Value | [b] | [c] | [f] | [r] | [s] |
|------------|-------|-------|-------|-------|-------|
| Frequency | 9 | 2 | 3 | 4 | 9 |
| Proportion | 0.333 | 0.074 | 0.111 | 0.148 | 0.333 |

stem.surface

| n | missing | distinct |
|----|---------|----------|
| 65 | 108 | 14 |

| Value | [f] | [g] | [h] | [i\t s] | [i\t t] | [i\t y] | [i] | [k\t s] | [k] | [s\t h] |
|------------|-------|-------|-------|---------|---------|---------|-------|---------|-------|---------|
| Frequency | 3 | 5 | 1 | 1 | 1 | 1 | 11 | 1 | 4 | 1 |
| Proportion | 0.046 | 0.077 | 0.015 | 0.015 | 0.015 | 0.015 | 0.169 | 0.015 | 0.062 | 0.015 |

| Value | [s] | [t] | [y\t s] | [y] |
|------------|-------|-------|---------|-------|
| Frequency | 15 | 7 | 1 | 13 |
| Proportion | 0.231 | 0.108 | 0.015 | 0.200 |

stem.color

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 41 |

| lowest : | [b u] | [e n] | [e u y] | [e y] | [e] |
|----------|-------|---------|---------|---------|-----|
| highest: | [w] | [y e n] | [y n] | [y o k] | [y] |

veil.type

| n | missing | distinct | value |
|---|---------|----------|-------|
| 9 | 164 | 1 | [u] |

| Value | [u] |
|------------|-----|
| Frequency | 9 |
| Proportion | 1 |

veil.color

| n | missing | distinct |
|----|---------|----------|
| 21 | 152 | 7 |

| Value | [e\t n] | [k] | [n] | [u] | [w] | [y\t w] | [y] |
|------------|---------|-------|-------|-------|-------|---------|-------|
| Frequency | 1 | 1 | 1 | 1 | 15 | 1 | 1 |
| Proportion | 0.048 | 0.048 | 0.048 | 0.048 | 0.714 | 0.048 | 0.048 |

has.ring

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| Value | [f] | [t] |
|------------|-------|-------|
| Frequency | 130 | 43 |
| Proportion | 0.751 | 0.249 |

ring.type

| n | missing | distinct |
|-----|---------|----------|
| 166 | 7 | 13 |

| Value | [e\t g] | [e] | [f] | [g\t p] | [g] | [l\t e] | [l\t p] | [l\t r] | [l] | [m] |
|------------|---------|-------|-------|---------|-------|---------|---------|---------|-------|-------|
| Frequency | 1 | 6 | 137 | 2 | 2 | 1 | 1 | 2 | 2 | 1 |
| Proportion | 0.006 | 0.036 | 0.825 | 0.012 | 0.012 | 0.006 | 0.006 | 0.012 | 0.012 | 0.006 |

| Value | [p] | [r] | [z] |
|------------|-------|-------|-------|
| Frequency | 2 | 3 | 6 |
| Proportion | 0.012 | 0.018 | 0.036 |

Spore.print.color

n missing distinct
18 155 8

| | | | | | | | | |
|------------|-------|---------|---------|-------|-------|---------|-------|-------|
| Value | [g] | [k\t r] | [k\t u] | [k] | [n] | [p\t w] | [p] | [w] |
| Frequency | 1 | 1 | 1 | 5 | 3 | 1 | 3 | 3 |
| Proportion | 0.056 | 0.056 | 0.056 | 0.278 | 0.167 | 0.056 | 0.167 | 0.167 |

habitat

n missing distinct
173 0 21

| | | | | | |
|----------|-------|-------|---------|-------|---------|
| lowest : | [d h] | [d] | [g d h] | [g d] | [g h d] |
| highest: | [m d] | [m h] | [m] | [p d] | [w] |

season

n missing distinct
173 0 45

| | | | | | | |
|----------|-------|-------|-------|-------|-------|-------|
| lowest : | [a w] | [a w] | [u a] | [a w] | [u a] | [a w] |
| highest: | [u a] | | | | | |

cap.diameter.min

| | | | | | | | | | | | | |
|-----|---------|----------|-------|-------|-------|-----|-----|-----|-----|-----|-----|-----|
| n | missing | distinct | Info | Mean | Gmd | .05 | .10 | .25 | .50 | .75 | .90 | .95 |
| 172 | 1 | 13 | 0.976 | 3.776 | 2.533 | 1 | 1 | 2 | 3 | 5 | 7 | 8 |

| | | | | | | | | | | | | | |
|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Value | 0.4 | 0.5 | 0.7 | 1.0 | 2.0 | 3.0 | 4.0 | 5.0 | 6.0 | 7.0 | 8.0 | 10.0 | 12.0 |
| Frequency | 2 | 4 | 1 | 17 | 39 | 24 | 26 | 29 | 11 | 4 | 9 | 4 | 2 |
| Proportion | 0.012 | 0.023 | 0.006 | 0.099 | 0.227 | 0.140 | 0.151 | 0.169 | 0.064 | 0.023 | 0.052 | 0.023 | 0.012 |

For the frequency table, variable is rounded to the nearest 0

cap.diameter.max

| | | | | | | | | | | | | |
|-----|---------|----------|-------|-------|-------|-----|-----|-----|-----|-----|-----|-----|
| n | missing | distinct | Info | Mean | Gmd | .05 | .10 | .25 | .50 | .75 | .90 | .95 |
| 172 | 1 | 19 | 0.991 | 9.199 | 6.147 | 2 | 3 | 5 | 8 | 12 | 15 | 20 |

| | | | | | | | | | | | | | | |
|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Value | 1.0 | 1.3 | 1.5 | 2.0 | 3.0 | 4.0 | 5.0 | 6.0 | 7.0 | 8.0 | 9.0 | 10.0 | 12.0 | 14.0 |
| Frequency | 3 | 1 | 4 | 7 | 6 | 12 | 18 | 16 | 7 | 16 | 3 | 28 | 18 | 3 |
| Proportion | 0.017 | 0.006 | 0.023 | 0.041 | 0.035 | 0.070 | 0.105 | 0.093 | 0.041 | 0.093 | 0.017 | 0.163 | 0.105 | 0.017 |

| | | | | | |
|------------|-------|-------|-------|-------|-------|
| Value | 15.0 | 18.0 | 20.0 | 25.0 | 30.0 |
| Frequency | 15 | 3 | 5 | 5 | 2 |
| Proportion | 0.087 | 0.017 | 0.029 | 0.029 | 0.012 |

For the frequency table, variable is rounded to the nearest 0

cap.diameter.avg

| | | | | | |
|---|---------|----------|------|------|-----|
| n | missing | distinct | Info | Mean | Gmd |
| 1 | 172 | 1 | 0 | 50 | NA |

| | |
|------------|----|
| Value | 50 |
| Frequency | 1 |
| Proportion | 1 |

stem.height.min

| | | | | | | | | | | | | |
|-----|---------|----------|-------|-------|-------|-----|-----|-----|-----|-----|-----|-----|
| n | missing | distinct | Info | Mean | Gmd | .05 | .10 | .25 | .50 | .75 | .90 | .95 |
| 170 | 3 | 11 | 0.955 | 4.382 | 2.157 | 2 | 2 | 3 | 4 | 5 | 7 | 8 |

| | | | | | | | | | | | |
|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Value | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 10 | 12 | 15 |
| Frequency | 2 | 21 | 38 | 52 | 24 | 15 | 3 | 7 | 5 | 1 | 2 |
| Proportion | 0.012 | 0.124 | 0.224 | 0.306 | 0.141 | 0.088 | 0.018 | 0.041 | 0.029 | 0.006 | 0.012 |

For the frequency table, variable is rounded to the nearest 0

stem.height.max

Stem-and-leaf plot of stem.height.max

| n | missing | distinct | Info | Mean | Gmd | .05 | .10 | .25 | .50 | .75 | .90 | .95 |
|-----|---------|----------|-------|-------|-------|------|------|------|------|-------|-------|-------|
| 170 | 3 | 18 | 0.976 | 9.029 | 4.205 | 4.45 | 5.00 | 6.00 | 8.00 | 10.00 | 15.00 | 15.00 |

| | | | | | | | | | | | | | | |
|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Value | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 14 | 15 | 18 |
| Frequency | 1 | 2 | 6 | 14 | 25 | 16 | 37 | 2 | 35 | 1 | 12 | 1 | 10 | 1 |
| Proportion | 0.006 | 0.012 | 0.035 | 0.082 | 0.147 | 0.094 | 0.218 | 0.012 | 0.206 | 0.006 | 0.071 | 0.006 | 0.059 | 0.006 |

| | | | | |
|------------|-------|-------|-------|-------|
| Value | 20 | 25 | 30 | 35 |
| Frequency | 4 | 1 | 1 | 1 |
| Proportion | 0.024 | 0.006 | 0.006 | 0.006 |

For the frequency table, variable is rounded to the nearest 0

stem.width.min

Stem-and-leaf plot of stem.width.min

| n | missing | distinct | Info | Mean | Gmd | .05 | .10 | .25 | .50 | .75 | .90 | .95 |
|-----|---------|----------|------|------|-------|-----|-----|-----|-----|-----|-----|-----|
| 162 | 11 | 15 | 0.98 | 8.83 | 6.785 | 2 | 2 | 4 | 8 | 10 | 20 | 20 |

| | | | | | | | | | | | | | | |
|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Value | 0.5 | 1.0 | 2.0 | 3.0 | 4.0 | 5.0 | 6.0 | 7.0 | 8.0 | 10.0 | 12.0 | 15.0 | 20.0 | 30.0 |
| Frequency | 1 | 6 | 17 | 12 | 12 | 19 | 7 | 1 | 10 | 38 | 1 | 20 | 16 | 1 |
| Proportion | 0.006 | 0.037 | 0.105 | 0.074 | 0.074 | 0.117 | 0.043 | 0.006 | 0.062 | 0.235 | 0.006 | 0.123 | 0.099 | 0.006 |

| | |
|------------|-------|
| Value | 40.0 |
| Frequency | 1 |
| Proportion | 0.006 |

For the frequency table, variable is rounded to the nearest 0

stem.width.max

Stem-and-leaf plot of stem.width.max

| n | missing | distinct | Info | Mean | Gmd | .05 | .10 | .25 | .50 | .75 | .90 | .95 |
|-----|---------|----------|-------|-------|-------|-----|-----|-----|-----|-----|-----|-----|
| 162 | 11 | 20 | 0.991 | 16.58 | 13.51 | 3 | 4 | 8 | 15 | 20 | 30 | 40 |

| | | | | | | | | | | | | | | |
|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Value | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 10 | 12 | 15 | 18 | 20 | 25 |
| Frequency | 1 | 5 | 10 | 9 | 5 | 3 | 3 | 17 | 15 | 11 | 19 | 4 | 26 | 10 |
| Proportion | 0.006 | 0.031 | 0.062 | 0.056 | 0.031 | 0.019 | 0.019 | 0.105 | 0.093 | 0.068 | 0.117 | 0.025 | 0.160 | 0.062 |

| | | | | | | |
|------------|-------|-------|-------|-------|-------|-------|
| Value | 30 | 40 | 50 | 60 | 80 | 100 |
| Frequency | 11 | 8 | 1 | 2 | 1 | 1 |
| Proportion | 0.068 | 0.049 | 0.006 | 0.012 | 0.006 | 0.006 |

For the frequency table, variable is rounded to the nearest 0

stem.width.avg

Stem-and-leaf plot of stem.width.avg

| n | missing | distinct | Info | Mean | Gmd |
|---|---------|----------|-------|-------|-------|
| 8 | 165 | 3 | 0.833 | 5.625 | 5.107 |

| | | | |
|------------|-------|-------|-------|
| Value | 1 | 2 | 10 |
| Frequency | 3 | 1 | 4 |
| Proportion | 0.375 | 0.125 | 0.500 |

For the frequency table, variable is rounded to the nearest 0

cap.diameter.imputed

Stem-and-leaf plot of cap.diameter.imputed

| n | missing | distinct | Info | Mean | Gmd | .05 | .10 | .25 | .50 | .75 | .90 | .95 |
|-----|---------|----------|-------|-------|-------|-----|-----|-----|-----|-----|------|------|
| 173 | 0 | 35 | 0.997 | 6.739 | 4.755 | 1.5 | 2.0 | 3.5 | 6.0 | 8.5 | 11.4 | 15.0 |

lowest : 0.7 0.75 1 1.25 1.5 , highest: 16.5 17.5 18.5 19 50

stem.height.imputed

Stem-and-leaf plot of stem.height.imputed

| n | missing | distinct | Info | Mean | Gmd | .05 | .10 | .25 | .50 | .75 | .90 | .95 |
|-----|---------|----------|-------|-------|-------|------|------|------|------|------|-------|-------|
| 170 | 3 | 29 | 0.993 | 6.706 | 3.105 | 3.50 | 3.50 | 5.00 | 6.00 | 7.50 | 10.05 | 12.27 |

lowest : 1.5 2 2.5 3 3.5 , highest: 16 16.5 17.5 19 25

stem.width.imputed

| n | missing | distinct | Info | Mean | Gmd | .05 | .10 | .25 | .50 | .75 | .90 | .95 |
|-----|---------|----------|-------|-------|-------|-------|-------|-------|--------|--------|--------|--------|
| 170 | 3 | 34 | 0.997 | 12.37 | 10.01 | 1.725 | 2.500 | 5.500 | 10.000 | 16.875 | 25.000 | 30.000 |

lowest : 0.75 1 1.5 2 2.5 , highest: 30 35 40 50 70

cap.shape.x

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|-------|-------|
| Value | 0 | 1 |
| Frequency | 63 | 110 |
| Proportion | 0.364 | 0.636 |

cap.shape.f

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|-------|-------|
| Value | 0 | 1 |
| Frequency | 99 | 74 |
| Proportion | 0.572 | 0.428 |

cap.shape.p

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|-------|-------|
| Value | 0 | 1 |
| Frequency | 158 | 15 |
| Proportion | 0.913 | 0.087 |

cap.shape.b

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|-------|-------|
| Value | 0 | 1 |
| Frequency | 150 | 23 |
| Proportion | 0.867 | 0.133 |

cap.shape.c

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|-------|-------|
| Value | 0 | 1 |
| Frequency | 165 | 8 |
| Proportion | 0.954 | 0.046 |

cap.shape.s

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|-------|-------|
| Value | 0 | 1 |
| Frequency | 137 | 36 |
| Proportion | 0.792 | 0.208 |

cap.shape.o

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|-------|-------|
| Value | 0 | 1 |
| Frequency | 161 | 12 |
| Proportion | 0.931 | 0.069 |

cap.surface.g

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|-------|-------|
| Value | 0 | 1 |
| Frequency | 157 | 16 |
| Proportion | 0.908 | 0.092 |

cap.surface.h

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|------|------|
| Value | 0 | 1 |
| Frequency | 147 | 26 |
| Proportion | 0.85 | 0.15 |

cap.surface.t

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|-------|-------|
| Value | 0 | 1 |
| Frequency | 136 | 37 |
| Proportion | 0.786 | 0.214 |

cap.surface.y

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|-------|-------|
| Value | 0 | 1 |
| Frequency | 150 | 23 |
| Proportion | 0.867 | 0.133 |

cap.surface.e

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|-------|-------|
| Value | 0 | 1 |
| Frequency | 162 | 11 |
| Proportion | 0.936 | 0.064 |

cap.surface.s

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|-------|-------|
| Value | 0 | 1 |
| Frequency | 140 | 33 |
| Proportion | 0.809 | 0.191 |

cap.surface.l

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|-------|-------|
| Value | 0 | 1 |
| Frequency | 169 | 4 |
| Proportion | 0.977 | 0.023 |

cap.surface.d

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|-------|-------|
| Value | 0 | 1 |
| Frequency | 155 | 18 |
| Proportion | 0.896 | 0.104 |

cap.surface.w

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|-------|-------|
| Value | 0 | 1 |
| Frequency | 165 | 8 |
| Proportion | 0.954 | 0.046 |

cap.surface.i

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|-------|-------|
| Value | 0 | 1 |
| Frequency | 164 | 9 |
| Proportion | 0.948 | 0.052 |

cap.surface.k

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|-------|-------|
| Value | 0 | 1 |
| Frequency | 163 | 10 |
| Proportion | 0.942 | 0.058 |

stem.surface.y

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|-------|-------|
| Value | 0 | 1 |
| Frequency | 158 | 15 |
| Proportion | 0.913 | 0.087 |

stem.surface.s

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|------|------|
| Value | 0 | 1 |
| Frequency | 154 | 19 |
| Proportion | 0.89 | 0.11 |

stem.surface.k

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|-------|-------|
| Value | 0 | 1 |
| Frequency | 168 | 5 |
| Proportion | 0.971 | 0.029 |

stem.surface.i

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|-------|-------|
| Value | 0 | 1 |
| Frequency | 159 | 14 |
| Proportion | 0.919 | 0.081 |

stem.surface.h

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|-------|-------|
| Value | 0 | 1 |
| Frequency | 171 | 2 |
| Proportion | 0.988 | 0.012 |

stem.surface.t

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|-------|-------|
| Value | 0 | 1 |
| Frequency | 165 | 8 |
| Proportion | 0.954 | 0.046 |

stem.surface.g

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|-------|-------|
| Value | 0 | 1 |
| Frequency | 168 | 5 |
| Proportion | 0.971 | 0.029 |

stem.surface.f

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|-------|-------|
| Value | 0 | 1 |
| Frequency | 170 | 3 |
| Proportion | 0.983 | 0.017 |

ring.type.g

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|-------|-------|
| Value | 0 | 1 |
| Frequency | 168 | 5 |
| Proportion | 0.971 | 0.029 |

ring.type.p

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|-------|-------|
| Value | 0 | 1 |
| Frequency | 168 | 5 |
| Proportion | 0.971 | 0.029 |

ring.type.e

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|-------|-------|
| Value | 0 | 1 |
| Frequency | 165 | 8 |
| Proportion | 0.954 | 0.046 |

ring.type.l

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|-------|-------|
| Value | 0 | 1 |
| Frequency | 167 | 6 |
| Proportion | 0.965 | 0.035 |

ring.type.f

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|-------|-------|
| Value | 0 | 1 |
| Frequency | 36 | 137 |
| Proportion | 0.208 | 0.792 |

ring.type.m

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|-------|-------|
| Value | 0 | 1 |
| Frequency | 172 | 1 |
| Proportion | 0.994 | 0.006 |

ring.type.r

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|-------|-------|
| Value | 0 | 1 |
| Frequency | 168 | 5 |
| Proportion | 0.971 | 0.029 |

ring.type.z

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|-------|-------|
| Value | 0 | 1 |
| Frequency | 167 | 6 |
| Proportion | 0.965 | 0.035 |

habitat.d

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|-------|-------|
| Value | 0 | 1 |
| Frequency | 22 | 151 |
| Proportion | 0.127 | 0.873 |

habitat.m

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|-------|-------|
| Value | 0 | 1 |
| Frequency | 156 | 17 |
| Proportion | 0.902 | 0.098 |

habitat.g

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|------|------|
| Value | 0 | 1 |
| Frequency | 135 | 38 |
| Proportion | 0.78 | 0.22 |

habitat.h

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|-------|-------|
| Value | 0 | 1 |
| Frequency | 160 | 13 |
| Proportion | 0.925 | 0.075 |

habitat.l

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|-------|-------|
| Value | 0 | 1 |
| Frequency | 155 | 18 |
| Proportion | 0.896 | 0.104 |

habitat.p

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|-------|-------|
| Value | 0 | 1 |
| Frequency | 171 | 2 |
| Proportion | 0.988 | 0.012 |

habitat.w

| n | missing | distinct |
|-----|---------|----------|
| 173 | 0 | 2 |

| | | |
|------------|-------|-------|
| Value | 0 | 1 |
| Frequency | 172 | 1 |
| Proportion | 0.994 | 0.006 |

habitat.u

| | n | missing | distinct |
|--|-----|---------|----------|
| | 173 | 0 | 2 |

| | | | |
|------------|--|-------|-------|
| Value | | 0 | 1 |
| Frequency | | 172 | 1 |
| Proportion | | 0.994 | 0.006 |

season.u

| | n | missing | distinct |
|--|-----|---------|----------|
| | 173 | 0 | 2 |

| | | | |
|------------|--|-------|-------|
| Value | | 0 | 1 |
| Frequency | | 33 | 140 |
| Proportion | | 0.191 | 0.809 |

season.a

| | n | missing | distinct |
|--|-----|---------|----------|
| | 173 | 0 | 2 |

| | | | |
|------------|--|-------|-------|
| Value | | 0 | 1 |
| Frequency | | 5 | 168 |
| Proportion | | 0.029 | 0.971 |

season.w

| | n | missing | distinct |
|--|-----|---------|----------|
| | 173 | 0 | 2 |

| | | | |
|------------|--|-------|-------|
| Value | | 0 | 1 |
| Frequency | | 132 | 41 |
| Proportion | | 0.763 | 0.237 |

season.s

| | n | missing | distinct |
|--|-----|---------|----------|
| | 173 | 0 | 2 |

| | | | |
|------------|--|-------|-------|
| Value | | 0 | 1 |
| Frequency | | 150 | 23 |
| Proportion | | 0.867 | 0.133 |

cap.color.clean.group

| | n | missing | distinct |
|--|-----|---------|----------|
| | 173 | 0 | 5 |

| | | | | | |
|------------|-------|-------|-------|-------|-------|
| Value | cool | dark | light | warm | other |
| Frequency | 3 | 39 | 23 | 7 | 101 |
| Proportion | 0.017 | 0.225 | 0.133 | 0.040 | 0.584 |

gill.color.clean.group

| | n | missing | distinct |
|--|-----|---------|----------|
| | 173 | 0 | 5 |

| | | | | | |
|------------|-------|-------|-------|-------|-------|
| Value | cool | dark | light | warm | other |
| Frequency | 1 | 15 | 50 | 13 | 94 |
| Proportion | 0.006 | 0.087 | 0.289 | 0.075 | 0.543 |

spore.print.color.clean.group

| | n | missing | distinct |
|------------|-------|---------|-------------|
| | 173 | 0 | 4 |
| Value | dark | light | warm other |
| Frequency | 9 | 3 | 3 158 |
| Proportion | 0.052 | 0.017 | 0.017 0.913 |

stem.color.clean.group

| | n | missing | distinct |
|------------|-------|---------|-------------------|
| | 173 | 0 | 5 |
| Value | cool | dark | light warm other |
| Frequency | 2 | 38 | 70 4 59 |
| Proportion | 0.012 | 0.220 | 0.405 0.023 0.341 |

veil.color.clean.group

| | n | missing | distinct |
|------------|-------|---------|-------------|
| | 173 | 0 | 4 |
| Value | cool | dark | light other |
| Frequency | 1 | 2 | 16 154 |
| Proportion | 0.006 | 0.012 | 0.092 0.890 |

Variables with all observations missing: stem.height.avg

0.4 Table1

Continuous variables (e.g., cap diameter, stem height, stem width) were analyzed using the Wilcoxon Rank-Sum Test, while categorical variables were assessed with Fisher's Exact Test to evaluate associations with mushroom edibility. To control for multiple comparisons, p-values were adjusted using the False Discovery Rate (FDR) correction via the Benjamini-Hochberg method.

Summary:

- Some numerical variables, such as cap diameter and stem width, initially showed significance but did not remain statistically significant after FDR adjustment.
- Stem root had a high proportion of missing values and could be considered negligible in the analysis.
- Cap shape (bell), cap surface (silky), cap color (cool), ring type (zone), and winter seasonality showed initial significance but did not hold after multiple testing correction.
- No variables showed strong evidence of association with edibility after FDR adjustment.

表 2: Characteristics of mushroom

| | Overall (N=173) | Edible (N=77) | Poisonous (N=96) | P.value | FDR |
|----------------------|--------------------|------------------|---------------------|---------|-------|
| does.bruise.or.bleed | | | | | |
| [f] | 143 (82.7%) | 63 (81.8%) | 80 (83.3%) | 0.841 | 1.000 |
| [t] | 30 (17.3%) | 14 (18.2%) | 16 (16.7%) | | |
| gill.attachment | | | | | |

| | | | | | |
|-----------------------|--------------------|-------------------|--------------------|---------|-------|
| [a d] | 8 (4.6%) | 5 (6.5%) | 3 (3.1%) | 0.206 | 0.792 |
| [a] | 32 (18.5%) | 11 (14.3%) | 21 (21.9%) | | |
| [d] | 25 (14.5%) | 9 (11.7%) | 16 (16.7%) | | |
| [e] | 16 (9.2%) | 10 (13.0%) | 6 (6.3%) | | |
| [f] | 10 (5.8%) | 4 (5.2%) | 6 (6.3%) | | |
| [p] | 17 (9.8%) | 12 (15.6%) | 5 (5.2%) | 0.358 | 0.899 |
| [s] | 16 (9.2%) | 7 (9.1%) | 9 (9.4%) | | |
| [x] | 21 (12.1%) | 9 (11.7%) | 12 (12.5%) | | |
| Missing | 28 (16.2%) | 10 (13.0%) | 18 (18.8%) | | |
| gill.spacing | | | | | |
| [c] | 70 (40.5%) | 29 (37.7%) | 41 (42.7%) | 0.070 | 0.459 |
| [d] | 22 (12.7%) | 13 (16.9%) | 9 (9.4%) | | |
| [f] | 10 (5.8%) | 4 (5.2%) | 6 (6.3%) | | |
| Missing | 71 (41.0%) | 31 (40.3%) | 40 (41.7%) | | |
| stem.root | | | | | |
| [b] | 9 (5.2%) | 6 (7.8%) | 3 (3.1%) | 0.483 | 0.899 |
| [c] | 2 (1.2%) | 0 (0%) | 2 (2.1%) | | |
| [f] | 3 (1.7%) | 0 (0%) | 3 (3.1%) | | |
| [r] | 4 (2.3%) | 0 (0%) | 4 (4.2%) | | |
| [s] | 9 (5.2%) | 4 (5.2%) | 5 (5.2%) | | |
| Missing | 146 (84.4%) | 67 (87.0%) | 79 (82.3%) | 0.007** | 0.207 |
| has.ring | | | | | |
| [f] | 130 (75.1%) | 60 (77.9%) | 70 (72.9%) | | |
| [t] | 43 (24.9%) | 17 (22.1%) | 26 (27.1%) | | |
| cap.diameter.imputed | | | | | |
| Mean (SD) | 6.74 (5.14) | 7.81 (6.26) | 5.88 (3.85) | 0.122 | 0.600 |
| Median [Min, Max] | 6.00 [0.700, 50.0] | 6.50 [1.00, 50.0] | 5.00 [0.700, 19.0] | | |
| stem.height.imputed | | | | | |
| Mean (SD) | 6.71 (3.17) | 7.05 (3.48) | 6.42 (2.88) | | |
| Median [Min, Max] | 6.00 [1.50, 25.0] | 6.00 [2.50, 25.0] | 6.00 [1.50, 17.5] | | |
| Missing | 3 (1.7%) | 0 (0%) | 3 (3.1%) | 0.005** | 0.207 |
| stem.width.imputed | | | | | |
| Mean (SD) | 12.4 (9.81) | 14.4 (10.8) | 10.7 (8.59) | | |
| Median [Min, Max] | 10.0 [0.750, 70.0] | 12.5 [1.00, 70.0] | 7.50 [0.750, 40.0] | | |
| Missing | 3 (1.7%) | 0 (0%) | 3 (3.1%) | | |
| Cap Shape (Convex) | | | | 0.115 | 0.600 |
| 0 | 63 (36.4%) | 23 (29.9%) | 40 (41.7%) | | |
| 1 | 110 (63.6%) | 54 (70.1%) | 56 (58.3%) | | |
| Cap Shape (Flat) | | | | | |
| 0 | 99 (57.2%) | 41 (53.2%) | 58 (60.4%) | | |
| 1 | 74 (42.8%) | 36 (46.8%) | 38 (39.6%) | 0.102 | 0.600 |
| Cap Shape (Spherical) | | | | | |
| 0 | 158 (91.3%) | 67 (87.0%) | 91 (94.8%) | | |
| 1 | 15 (8.7%) | 10 (13.0%) | 5 (5.2%) | | |
| Cap Shape (Bell) | | | | | |
| 0 | 150 (86.7%) | 72 (93.5%) | 78 (81.3%) | 0.023* | 0.271 |
| 1 | 23 (13.3%) | 5 (6.5%) | 18 (18.8%) | | |
| Cap Shape (Conical) | | | | | |
| 0 | 165 (95.4%) | 73 (94.8%) | 92 (95.8%) | | |
| 1 | 8 (4.6%) | 4 (5.2%) | 4 (4.2%) | | |

| | | | | | |
|------------------------|-------------|------------|------------|--------|-------|
| Cap Shape (Sunken) | | | | | |
| 0 | 137 (79.2%) | 60 (77.9%) | 77 (80.2%) | 0.711 | 0.941 |
| 1 | 36 (20.8%) | 17 (22.1%) | 19 (19.8%) | | |
| Cap Shape (Other) | | | | | |
| 0 | 161 (93.1%) | 73 (94.8%) | 88 (91.7%) | 0.552 | 0.928 |
| 1 | 12 (6.9%) | 4 (5.2%) | 8 (8.3%) | | |
| Cap Surface (Grooved) | | | | | |
| 0 | 157 (90.8%) | 70 (90.9%) | 87 (90.6%) | 1.000 | 1.000 |
| 1 | 16 (9.2%) | 7 (9.1%) | 9 (9.4%) | | |
| Cap Surface (Shiny) | | | | | |
| 0 | 147 (85.0%) | 64 (83.1%) | 83 (86.5%) | 0.669 | 0.941 |
| 1 | 26 (15.0%) | 13 (16.9%) | 13 (13.5%) | | |
| Cap Surface (Sticky) | | | | | |
| 0 | 136 (78.6%) | 62 (80.5%) | 74 (77.1%) | 0.710 | 0.941 |
| 1 | 37 (21.4%) | 15 (19.5%) | 22 (22.9%) | | |
| Cap Surface (Scaly) | | | | | |
| 0 | 150 (86.7%) | 65 (84.4%) | 85 (88.5%) | 0.502 | 0.899 |
| 1 | 23 (13.3%) | 12 (15.6%) | 11 (11.5%) | | |
| Cap Surface (Fleshy) | | | | | |
| 0 | 162 (93.6%) | 73 (94.8%) | 89 (92.7%) | 0.757 | 0.950 |
| 1 | 11 (6.4%) | 4 (5.2%) | 7 (7.3%) | | |
| Cap Surface (Smooth) | | | | | |
| 0 | 140 (80.9%) | 59 (76.6%) | 81 (84.4%) | 0.243 | 0.792 |
| 1 | 33 (19.1%) | 18 (23.4%) | 15 (15.6%) | | |
| Cap Surface (Leathery) | | | | | |
| 0 | 169 (97.7%) | 75 (97.4%) | 94 (97.9%) | 1.000 | 1.000 |
| 1 | 4 (2.3%) | 2 (2.6%) | 2 (2.1%) | | |
| Cap Surface (Wrinkled) | | | | | |
| 0 | 155 (89.6%) | 69 (89.6%) | 86 (89.6%) | 1.000 | 1.000 |
| 1 | 18 (10.4%) | 8 (10.4%) | 10 (10.4%) | | |
| Cap Surface (Waxy) | | | | | |
| 0 | 165 (95.4%) | 74 (96.1%) | 91 (94.8%) | 0.734 | 0.941 |
| 1 | 8 (4.6%) | 3 (3.9%) | 5 (5.2%) | | |
| Cap Surface (Fibrous) | | | | | |
| 0 | 164 (94.8%) | 75 (97.4%) | 89 (92.7%) | 0.302 | 0.891 |
| 1 | 9 (5.2%) | 2 (2.6%) | 7 (7.3%) | | |
| Cap Surface (Silky) | | | | | |
| 0 | 163 (94.2%) | 76 (98.7%) | 87 (90.6%) | 0.044* | 0.371 |
| 1 | 10 (5.8%) | 1 (1.3%) | 9 (9.4%) | | |
| Stem Surface (Scaly) | | | | | |
| 0 | 158 (91.3%) | 72 (93.5%) | 86 (89.6%) | 0.424 | 0.899 |
| 1 | 15 (8.7%) | 5 (6.5%) | 10 (10.4%) | | |
| Stem Surface (Smooth) | | | | | |
| 0 | 154 (89.0%) | 66 (85.7%) | 88 (91.7%) | 0.231 | 0.792 |
| 1 | 19 (11.0%) | 11 (14.3%) | 8 (8.3%) | | |
| Stem Surface (Silky) | | | | | |
| 0 | 168 (97.1%) | 75 (97.4%) | 93 (96.9%) | 1.000 | 1.000 |
| 1 | 5 (2.9%) | 2 (2.6%) | 3 (3.1%) | | |
| Stem Surface (Fibrous) | | | | | |
| 0 | 159 (91.9%) | 72 (93.5%) | 87 (90.6%) | 0.582 | 0.928 |

| | | | | | |
|------------------------|-------------|------------|------------|--------|-------|
| 1 | 14 (8.1%) | 5 (6.5%) | 9 (9.4%) | | |
| Stem Surface (Shiny) | | | | | |
| 0 | 171 (98.8%) | 77 (100%) | 94 (97.9%) | 0.503 | 0.899 |
| 1 | 2 (1.2%) | 0 (0%) | 2 (2.1%) | | |
| Stem Surface (Sticky) | | | | | |
| 0 | 165 (95.4%) | 73 (94.8%) | 92 (95.8%) | 1.000 | 1.000 |
| 1 | 8 (4.6%) | 4 (5.2%) | 4 (4.2%) | | |
| Stem Surface (Grooved) | | | | | |
| 0 | 168 (97.1%) | 77 (100%) | 91 (94.8%) | 0.066. | 0.459 |
| 1 | 5 (2.9%) | 0 (0%) | 5 (5.2%) | | |
| Stem Surface (None) | | | | | |
| 0 | 170 (98.3%) | 77 (100%) | 93 (96.9%) | 0.255 | 0.792 |
| 1 | 3 (1.7%) | 0 (0%) | 3 (3.1%) | | |
| Ring Type (Grooved) | | | | | |
| 0 | 168 (97.1%) | 75 (97.4%) | 93 (96.9%) | 1.000 | 1.000 |
| 1 | 5 (2.9%) | 2 (2.6%) | 3 (3.1%) | | |
| Ring Type (Pendant) | | | | | |
| 0 | 168 (97.1%) | 75 (97.4%) | 93 (96.9%) | 1.000 | 1.000 |
| 1 | 5 (2.9%) | 2 (2.6%) | 3 (3.1%) | | |
| Ring Type (Evanescent) | | | | | |
| 0 | 165 (95.4%) | 74 (96.1%) | 91 (94.8%) | 0.734 | 0.941 |
| 1 | 8 (4.6%) | 3 (3.9%) | 5 (5.2%) | | |
| Ring Type (Large) | | | | | |
| 0 | 167 (96.5%) | 73 (94.8%) | 94 (97.9%) | 0.409 | 0.899 |
| 1 | 6 (3.5%) | 4 (5.2%) | 2 (2.1%) | | |
| Ring Type (None) | | | | | |
| 0 | 36 (20.8%) | 16 (20.8%) | 20 (20.8%) | 1.000 | 1.000 |
| 1 | 137 (79.2%) | 61 (79.2%) | 76 (79.2%) | | |
| Ring Type (Movable) | | | | | |
| 0 | 172 (99.4%) | 76 (98.7%) | 96 (100%) | 0.445 | 0.899 |
| 1 | 1 (0.6%) | 1 (1.3%) | 0 (0%) | | |
| Ring Type (Flaring) | | | | | |
| 0 | 168 (97.1%) | 74 (96.1%) | 94 (97.9%) | 0.657 | 0.941 |
| 1 | 5 (2.9%) | 3 (3.9%) | 2 (2.1%) | | |
| Ring Type (Zone) | | | | | |
| 0 | 167 (96.5%) | 77 (100%) | 90 (93.8%) | 0.034* | 0.334 |
| 1 | 6 (3.5%) | 0 (0%) | 6 (6.3%) | | |
| Habitat (woods) | | | | | |
| 0 | 22 (12.7%) | 8 (10.4%) | 14 (14.6%) | 0.494 | 0.899 |
| 1 | 151 (87.3%) | 69 (89.6%) | 82 (85.4%) | | |
| Habitat (meadows) | | | | | |
| 0 | 156 (90.2%) | 69 (89.6%) | 87 (90.6%) | 1.000 | 1.000 |
| 1 | 17 (9.8%) | 8 (10.4%) | 9 (9.4%) | | |
| Habitat (grasses) | | | | | |
| 0 | 135 (78.0%) | 62 (80.5%) | 73 (76.0%) | 0.580 | 0.928 |
| 1 | 38 (22.0%) | 15 (19.5%) | 23 (24.0%) | | |
| Habitat (heaths) | | | | | |
| 0 | 160 (92.5%) | 72 (93.5%) | 88 (91.7%) | 0.775 | 0.953 |
| 1 | 13 (7.5%) | 5 (6.5%) | 8 (8.3%) | | |
| Habitat (leaves) | | | | | |

| | | | | | |
|-------------------|-------------|------------|------------|--------|-------|
| 0 | 155 (89.6%) | 66 (85.7%) | 89 (92.7%) | 0.143 | 0.603 |
| 1 | 18 (10.4%) | 11 (14.3%) | 7 (7.3%) | | |
| Habitat (paths) | | | | | |
| 0 | 171 (98.8%) | 77 (100%) | 94 (97.9%) | 0.503 | 0.899 |
| 1 | 2 (1.2%) | 0 (0%) | 2 (2.1%) | | |
| Habitat (waste) | | | | | |
| 0 | 172 (99.4%) | 76 (98.7%) | 96 (100%) | 0.445 | 0.899 |
| 1 | 1 (0.6%) | 1 (1.3%) | 0 (0%) | | |
| Habitat (urban) | | | | | |
| 0 | 172 (99.4%) | 76 (98.7%) | 96 (100%) | 0.445 | 0.899 |
| 1 | 1 (0.6%) | 1 (1.3%) | 0 (0%) | | |
| Summer | | | | | |
| 0 | 33 (19.1%) | 16 (20.8%) | 17 (17.7%) | 0.698 | 0.941 |
| 1 | 140 (80.9%) | 61 (79.2%) | 79 (82.3%) | | |
| Autumn | | | | | |
| 0 | 5 (2.9%) | 3 (3.9%) | 2 (2.1%) | 0.657 | 0.941 |
| 1 | 168 (97.1%) | 74 (96.1%) | 94 (97.9%) | | |
| Winter | | | | | |
| 0 | 132 (76.3%) | 52 (67.5%) | 80 (83.3%) | 0.019* | 0.271 |
| 1 | 41 (23.7%) | 25 (32.5%) | 16 (16.7%) | | |
| Spring | | | | | |
| 0 | 150 (86.7%) | 65 (84.4%) | 85 (88.5%) | 0.502 | 0.899 |
| 1 | 23 (13.3%) | 12 (15.6%) | 11 (11.5%) | | |
| Cap color | | | | | |
| cool | 3 (1.7%) | 0 (0%) | 3 (3.1%) | 0.012* | 0.236 |
| dark | 39 (22.5%) | 22 (28.6%) | 17 (17.7%) | | |
| light | 23 (13.3%) | 13 (16.9%) | 10 (10.4%) | | |
| warm | 7 (4.0%) | 0 (0%) | 7 (7.3%) | | |
| other | 101 (58.4%) | 42 (54.5%) | 59 (61.5%) | | |
| Gill color | | | | | |
| cool | 1 (0.6%) | 1 (1.3%) | 0 (0%) | 0.240 | 0.792 |
| dark | 15 (8.7%) | 6 (7.8%) | 9 (9.4%) | | |
| light | 50 (28.9%) | 28 (36.4%) | 22 (22.9%) | | |
| warm | 13 (7.5%) | 5 (6.5%) | 8 (8.3%) | | |
| other | 94 (54.3%) | 37 (48.1%) | 57 (59.4%) | | |
| Spore print color | | | | | |
| dark | 9 (5.2%) | 2 (2.6%) | 7 (7.3%) | 0.537 | 0.928 |
| light | 3 (1.7%) | 2 (2.6%) | 1 (1.0%) | | |
| warm | 3 (1.7%) | 1 (1.3%) | 2 (2.1%) | | |
| other | 158 (91.3%) | 72 (93.5%) | 86 (89.6%) | | |
| Stem color | | | | | |
| cool | 2 (1.2%) | 1 (1.3%) | 1 (1.0%) | 0.139 | 0.603 |
| dark | 38 (22.0%) | 17 (22.1%) | 21 (21.9%) | | |
| light | 70 (40.5%) | 37 (48.1%) | 33 (34.4%) | | |
| warm | 4 (2.3%) | 0 (0%) | 4 (4.2%) | | |
| other | 59 (34.1%) | 22 (28.6%) | 37 (38.5%) | | |
| Veil color | | | | | |
| cool | 1 (0.6%) | 0 (0%) | 1 (1.0%) | 0.646 | 0.941 |
| dark | 2 (1.2%) | 0 (0%) | 2 (2.1%) | | |
| light | 16 (9.2%) | 8 (10.4%) | 8 (8.3%) | | |

| | | | |
|-------|-------------|------------|------------|
| other | 154 (89.0%) | 69 (89.6%) | 85 (88.5%) |
|-------|-------------|------------|------------|
