

Pedigree analysis and relatedness inference

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Exercise set IV: Disaster victim identification with DIVIANA

The online version of **DIVIANA** is available here: <https://magnusdv.shinyapps.io/diviana/>.

For optimal performance we recommend running **DIVIANA** locally from RStudio. To set this up, execute the following in a fresh session:

```
# install.packages("pak") <--- do this if the command below fails
pak::pak(c("magnusdv/dvir", "magnusdv/diviana"), dep = T, ask = F)
```

After installing the packages, you may launch **DIVIANA**:

```
diviana::launchApp()
```

Exercise IV-1 (Plane crash)

- Load the **planecrash** example data and click *Overview* to view a plot of the dataset. How many victims, missing individuals, and reference families are there?
- Go to **MARKERS** and inspect the information. Click on a marker and display its allele frequencies.
- Open the **ANALYSIS** tab and click **SOLVE**. Study the output and explain the solution.
- What is an *Undisputed* match in DIVIANA? (Hint: This uses the pairwise LR_s.)
- Study the output log. Was joint analysis used in this case? Why not?
- Reduce the LR threshold to 1000, and re-analyse the data. Explain the changes.
- Apply a Standard mutation model to all markers and re-analyse the data. Explain the changes.
- Go to **RELATEDNESS** and check the estimated PM-PM relationships. One pair stands out. Who are they, and what is their most likely relationship?

Exercise IV-2 (Plane crash cont.)

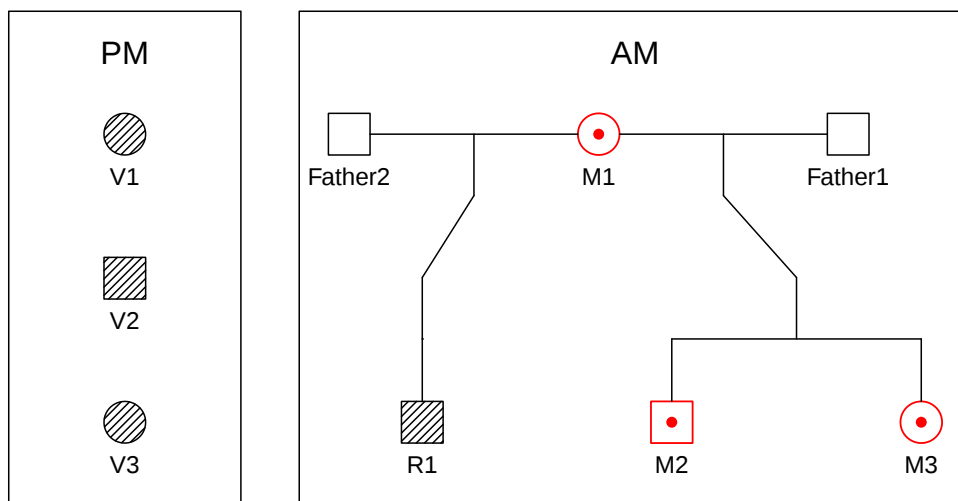
Reset DIVIANA and load the **planecrash** dataset again. In each point below, do the described changes, save the pedigree and re-analyse the dataset. Explain the conclusions for the family in question.

- Modify family F1 so that the mother (individual 1) is missing instead of the daughter.
- In family F2, add a full sister to the missing person M2, named "M2-2", who is also missing.
- Add a new family F6 to the dataset, containing two missing sisters named A and B. This family has no typed reference individuals.

Exercise IV-3 (Car crash)

Required file: KETPex498.fam

This exercise is based on Exercise 4.9.8 in the book *Mass identification* (Kling et al., 2021), which starts: *Following an accident where a car is crashed into sea, you are tasked with the mission to identify three persons, deceased in the accident.* The following plot summarises the case:



- Load the file `KETPex498.fam` into DIVIANA using the *Import* module in the **DATA** tab. Click **Overview** and comment on how the plot differs from the figure above.
- Modify the pedigree so that the two half-siblings of R1 are also missing. Rename the missing persons to M1, M2, and M3 as in the figure.
- Use the **RELATEDNESS** tab to estimate all AM-PM and PM-PM relationships. Comment on the results.
- Go to the **ANALYSIS** tab and click **SOLVE**. Comment first on the table of exclusions (**EX**).
- Comment on the pairwise LR matrix (**LR**). Explain why joint analysis may be a good idea in this case.
- What is the GLR for $M2 = V2$? Explain how to find this GLR in the **Joint** table.
- Re-run the analysis with “Ignore Sex” checked. What is the impact of ignoring sex in the identification?
- Try some different frequency databases and different mutation models. Are there any indications that results are sensitive to allele frequencies or choice of mutation model?
- Return to the original allele frequencies and mutation model. Run **SOLVE** and download the results. Inspect the sheets of the Excel output.