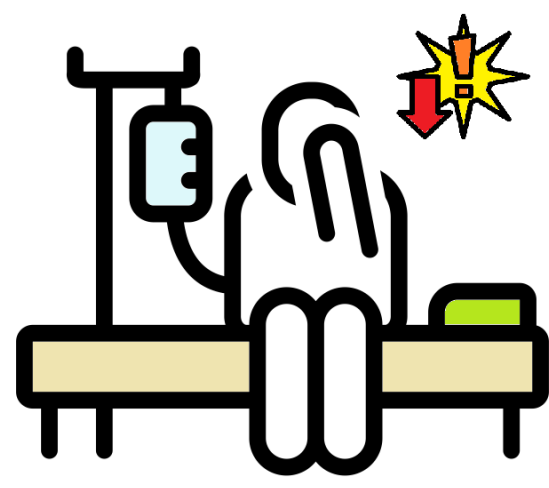


## THE PROBLEM



Cytokine storms significantly influence systemic inflammatory responses and septic patient outcome, highlighting the critical role of cytokine profiling in understanding and predicting patient’s outcome [1], which holds significant potential for future clinical and therapeutic applications, potentially leading to rapid and economic biomarkers of mortality prediction at ICU.

## THE GOAL

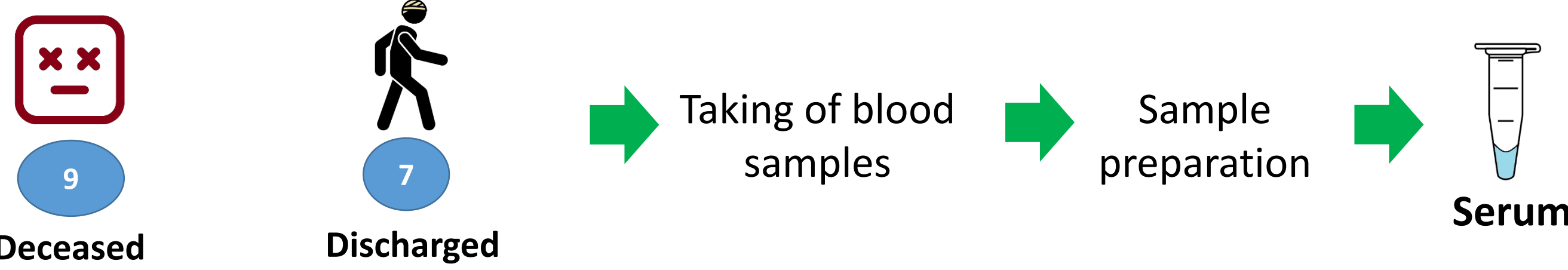


The present work aims to **evaluate how serum cytokines can predict the outcome** of septic patients at intensive care units.

## MATERIALS & METHODS

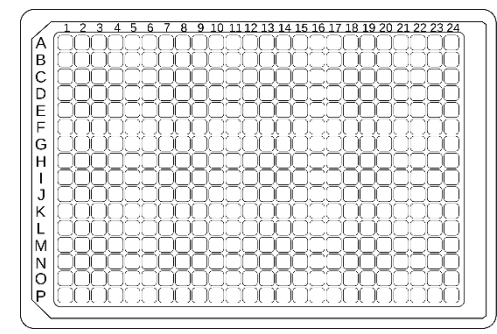


### A. BIOLOGICAL ASSAY: 16 ICU patients



### B. Cytokine Assay:

**Comprehensive set of 21 cytokines analyzed:** ITAC, GM-CSF, Fractalkine, IFN-g, IL-10, MIP-3a, IL-12p70, IL-13, IL-17a, IL-1b, IL-2, IL-21, IL-4, IL-23, IL-5, IL-6, IL-7, IL-8, MIP-1a, MIP-1b, and TNF-a.



**Milliplex 384-Well High Sensitivity Human T Cell Magnetic Bead Panel**

### t-SNE

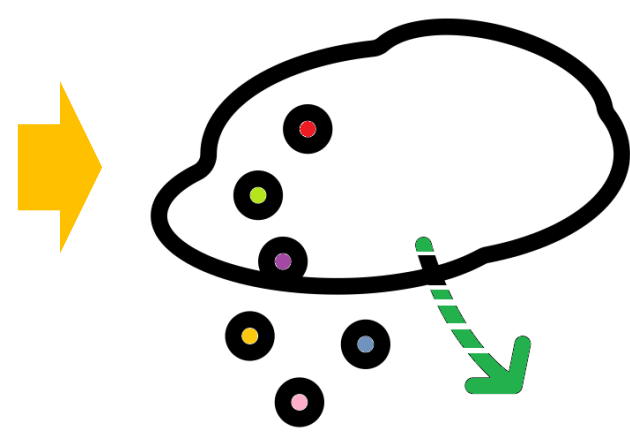
(t-distributed stochastic neighbour embedding), performed with:



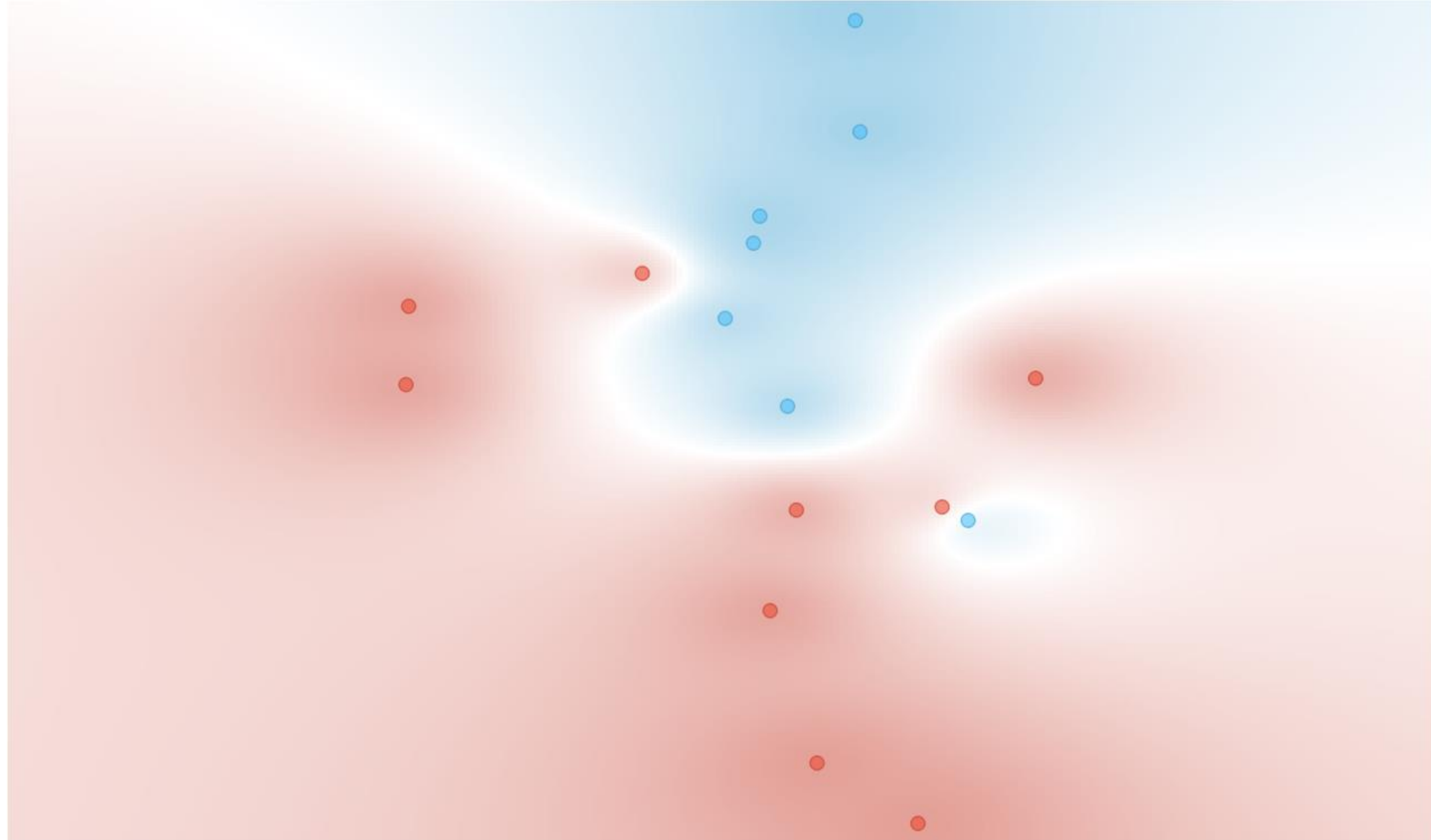
**Orange 3.19.0**  
(University of Ljubljana, Slovenia)

Machine Learning learner models were used and a feature selection algorithm (Gini Decrease), was applied to all models, to identify and select the most relevant cytokines for the target variable.

**A total of 16 patients, all hospitalised at an ICU, were considered.** Patients between the two groups (deceased and discharged) did not present significant differences concerning gender or age ( $p > 0.05$ ).



**5 cytokines were found to be the most important in death discrimination:** IL-6, MIP-3a, IL-8, IL-12p70, and IL-10.



**Fig.1.** t-SNE of the 16 total ICU patients with discharged (blue) and deceased (red) ICU patients.

**Table.1.** Confusion matrix (showing number of instances).

	Discharged	Deceased	$\Sigma$
Discharged	6	1	7
Deceased	1	8	9
$\Sigma$	7	9	16

Of all the learner models tested (with a stratified cross-validation, 5 folds), the Naïve Bayes model performance trumped those with both a sensitivity and specificity above 86%.

## RESULTS



## CONCLUSIONS

Preliminary findings indicate that IL-6, MIP-3a, IL-8, IL-12p70, and IL-10 are notably linked to sepsis outcomes. The relevance of these cytokines aligns with existing literature on their roles in inflammation and immune responses [2]. Predictive models constructed using the Naive Bayes models showed promising results, with sensitivity and specificity exceeding 86%. This study underscores the importance of cytokine profiling in sepsis, highlighting key biomarkers for predicting patient outcomes.



## ACKNOWLEDGEMENTS:

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