Universidad de Navarra
Facultad de Ciencias

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MÁSTER EN CIENCIA DE DATOS PARA CIENCIAS EXPERIMENTALES

Proyecto Nº 11

Título: Towards a virtual CAR-T cell via Deep Generative models

Departamento/ Laboratorio: Biologia Computacional (CIMA)

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Resumen:

In this TFM the student will work towards the development of the Virtual CAR-T cell: an AI model that predicts how gene edits will change the CAR-T transcriptional programs, persistence, and efficacy. Because testing every possible gene edit in the lab is slow and expensive, we'll use AI to learn from single-cell experiments (e.g., Perturb-seq, which measures how specific edits change gene activity one cell at a time). The goal is to quickly simulate new edit combinations, highlight designs that should improve CAR-T persistence and tumor-killing ability, and flag edits that might cause unwanted side effects.

Methodologically, the thesis will build a deep causal representation learning model with three components: (1) a generative module to simulate single-cell transcriptional responses to single and combinatorial edits; (2) a causal/structural prior over gene-set activities to enforce interpretability and enable counterfactual queries; and (3) a transfer/domain-adaptation layer to bridge from available immune Perturb-seq datasets to CAR-T contexts.

OPTATIVAS RECOMENDADAS

1. Advance topics in Machine Learning
2. Deep Learning
3. Análisis de datos de alto rendimiento
4.