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AI TO OPTIMIZE MYOBLAST TRANSPLANTATION FOR MUSCLE REPAIR

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Introduction:

In the sphere of regenerative medicine, Myoblast Transplantation[(1)] is one of important approaches. Several factors influencing the engraphment and the long-time survival of the cells have to be ensured. At first, myoblasts are isolated from the patient or a donor, cultured in vitro, and then transplanted into the damaged muscle tissue. These live cells are intended to differentiate into muscle fibers, integrate with the host tissue, and help restore muscle function. So, in the end-to-end workflow of transplantation, tracking and monitoring live cells is a critical and mandatory process. Tracking involves the migration, differentiation, and fusion with muscle fibers in the recipient tissue which helps us understand how well the transplanted cells are surviving, differentiating, and contributing to muscle regeneration. However, the manual tracking is very difficult and not helpful for personalised regenerative medicine and hence the machine learning[(2)] model can be applied instead, however there are several challenges. The first and foremost challenge is that the live cells are not stained and they do not have any specific shapes and they can not be stained. The machine learning model will help the research involving regenerative medicine to be more advanced and effective with high precision, so that it will impact the common people.

Main part.

The objective of our project is to develop a generalised machine learning model for observing the behaviour of the live cells such that:

1) The strategy of segmentation of myoblasts should be invariant of the shape of the cells.
2) It should not be fully dependent on any model which requires rigorous training.
3) A tool, accompanied by different algorithms will be incorporated as the autonomous agent for studying the cell characteristics and generate the report on its predictions with detail exploratory data analysis.
4) The tool will be facilitated with user friendly GUI for the researchers and accompanied by both unsupervised and semi-supervised learning.

Apart from the Neural Network, several clustering techniques and mathematical / statistical models will be explored.

Conclusions.

Publicly available machine learning model has been used for segmentation, classification and prediction job. The results proves that the unsupervised learning can work with up to the expectation, when leveraged with calibration technique.

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References:

1.Partridge T. Myoblast transplantation // Neuromuscular Disorders. 2002. Vol. 12.
2.Yang X. et al. A live-cell image-based machine learning strategy for reducing variability in PSC differentiation systems // Cell Discovery. 2023. Vol. 9, № 1.