HBP SURGERY WEEK 2023
MARCH 23 THU - 25 SAT, 2023 | BEXCO, BUSAN, KOREA
www.khbps.org
& The 58th Annual Congress of the Korean Association of HBP Surgery
The Korean Association of Hepato-Biliary-Pancreatic Surgery

ABST-0069

Preoperative Detection Of Hepatocellular Carcinoma's Microvascular Invasion On Ct-scan By Artificial-intelligence And Radiomics Analyses

Simone FAMULARO*[1], Flavio MILANA[1], Matteo DONADON[2], Camilla PENZO[3], Matteo BORTOLOTTO[4], Cesare MAINO[5], Jacques MARESCAUX[2], Michele DIANA[6], Felice GIULIANTE[7], Francesco ARDITO[7], Fabrizio ROMANO[4], Gian Luca GRAZI[7], Davide BERNASCONI[1], Guido TORZILLI[1]

[1]*Department Of Hepatobiliary And General Surgery, IRCCS Humanitas Research Hospital, Rozzano, Milan, ITALY*
[2]*Department Of Surgery, School Of Medicine And Surgery, University Of Milan-Bicocca, ITALY*
[3]*Department Of Radiology, San Gerardo Hospital, Monza, ITALY*
[4]*Department Of General, Digestive And Endocrine Surgery, University Hospital Of Strasbourg, FRANCE*
[5]*Hepatobiliary Surgery Unit, Fondazione Policlinico Universitario A. Gemelli, IRCCS Rome, ITALY*
[6]*Division Of Hepatobiliarypancreatic Unit, IRCCS - Regina Elena National Cancer Institute, Rome, ITALY*
[7]*Center Of Biostatistics For Clinical Epidemiology, School Of Medicine And Surgery, University Of Milan - Bicocca, ITALY*

Background : Microvascular invasion (MVI) is the main risk factor for overall mortality and recurrence after surgery for hepatocellular carcinoma (HCC). Its diagnosis can be made only postoperatively on the histological specimen. The aim of this preliminary study was to train machine-learning models to predict MVI on preoperative CT scan.

Methods : Clinical data and 3-phases CT scans were retrospectively collected among 4 Italian centres. After an initial manual segmentation, an algorithm was developed to automatically identify the liver and the tumor on CT scans. Radiomics features were automatically extracted from the tumoral, peritumoral and healthy liver areas in each phase. Principal component analysis (PCA) was performed to reduce the dimensions of the dataset. Data were divided between training (70%) and test (30%) sets. Random-Forest (RF), fully connected Artificial neural network (neuralnet) and extreme gradient boosting (XGB) models were fitted to predict MVI. Hyperparameters tuning was made to reduce the out-of-bag error.

Results : Between 2008 and 2022, 218 consecutive preoperative CT scans of patients affected by HCC and submitted to surgery were collected. At the histological specimen 33.02% patients had MVI. The Jaccard index between manual and algorithm segmentations was 90%. First and second order radiomics features were extracted, obtaining 672 variables per patient. PCA selected 58 dimensions explaining >95% of the variance. After standardization and normalization, RF, neuralnet and XGB were fitted to predict the presence of MVI. Tuning parameters were: 1) RF: n.tree=500, mtry=30; 2) Neuralnet: 2 hidden layer with 40 and 20 neurons, learning rate= 0.001, threshold for termination= 1%, activation function= sigmoid; 3) XGB: nrounds = 100, max_depth = 3, eta = 0.3. The models were then fitted in the testset to estimate prediction accuracy by confusion-matrix. RF was the best performer (Acc=98.4%, 95%CI: 0.91-0.99, Sens: 95.2%, Spec: 100%, PPV: 100% and NPV: 97.7%)

Conclusions : RF model predicted automatically MVI with a never-before reached accuracy.

Corresponding Author : **Simone FAMULARO** (simone.famularo@gmail.com)