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Optimal shape perserving linear operators with different types of data

In 1980, H. Berens and R. DeVore (*A characterization of Bernstein polynomials*, in Approximation Theory III, Proc. Conf., Austin, Texas, 1980, 213–219) showed that classical Bernstein operators are the best in certain sense. They proved that if L is a linear operator mapping real functions defined on $[0, 1]$ onto polynomial functions of degree less or equal to n, preserving the positivity and the sign of all the derivatives and fixing the linear polynomial, then the eigenvalue corresponding to the polynomial functions of degree two, λ_2, verifies $\lambda_2 \leq \frac{n-1}{n}$, and the identity is satisfied only by Bernstein operators.

Now, we consider linear polynomial operators that use certain type of data (values of functions in some points, derivatives, moments, etc.) and we consider the preservation of the sign of only one derivative. For each case, we look for a optimal operator. We show that Bernstein, Bernstein–Kantorovich and Bernstein–Durrmeyer operators are optimals in certain cases. In others, we show new Bernstein-type operators.