Ideal notions

All the studies in [BDS, Su16, SoSu] are focused on ideal modifications of several standard objects in mathematical analysis and topology. It is mainly convergence, covers, and cardinal invariants. We tried to use set-theoretical and topological knowledge of ideals on natural numbers. Corresponding ideal terminology was set up in [BDS, SoSu]

In [Su16], we have shown that one possible ideal version of quasi-normal convergence of a sequence of real-valued functions is weaker than pointwise convergence on any set, provided it is considered with respect to a non-P-point. Actually, all such ideals were described combinatorially via modification of P-ideal property. We have obtained combinatorial characterization of uniformity numbers of ideal versions of space not distinguishing pointwise and quasi-normal convergence called QN-space and covering selection principle $\mathrm{S}_1(\Gamma,\Gamma)$.

Applying well-known set-theoretical consistency results and taking suitable ideals, we have shown a consistency of distinguished ideal version of both, QN-space in [Su16] and $\mathrm{S}_1(\Gamma,\Gamma)$-space in [SoSu], from standard QN-space and $\mathrm{S}_1(\Gamma,\Gamma)$-space, respectively.

References

[SoSu] Šottová V. and Šupina J., *Principle $S_1(\mathcal{P},\mathcal{R})$: ideals and functions,* Topology Appl. **258** (2019), 282–304.

[BDS] Bukovský L., Das P. and Šupina J.: *Ideal quasi-normal convergence and related notions*, Colloq. Math. **146** (2017), 265–281.

[Su16] Šupina J.: *Ideal* QN-*spaces*, J. Math. Anal. Appl. **434** (2016), 477–491.

Sequence selection principles

In [BuSu12, Su13, BuSu13], we studied the following version of the sequence selection property and its applications. We say that a topological space X has the sequence selection property, if for any functions $f_{n,m} \in \mathrm{C}_p(X)$ and $f_n, f \in {}^X\mathbb{R}$ such that

a) $f_{n,m} \to f_n$ on X for every $n \in \omega$,

b) $f_n \to f$ on X,

there exists an unbounded $\beta \in {}^{\omega}\omega$ such that

$$f_{n,\beta(n)} \to f \text{ on } X.$$

If there exist an increasing $\alpha \in {}^{\omega}\omega$ and an unbounded $\beta \in {}^{\omega}\omega$ with $f_{\alpha(n),\beta(n)} \to f$ on X then we say that X has the weak sequence selection property. We considered stronger convergences of sequences and restrictions of functions f_n, f (e.g. upper semicontinuous) as well.

In [BuSu12], using sequence selection property, we have found an alternative proof of Tsaban - Zdomskyy Theorem (a space not distinguishing pointwise and quasi-normal convergence called QN-space is the space with bounded Borel images in the Baire space), which deeply analyzes the result. Furthermore, other application of sequence selection property led to an alternative proof of Recław Theorem on QN-space (perfectly normal QN-space is a σ-set).

In [Su13], we have characterized (via sequence selection property) spaces not distinguishing pointwise and quasi-normal convergence, QN-space and wQN-space, and hereditary versions of covering selection principles, $\mathrm{S}_1(\Gamma,\Gamma)$-space and Hurewicz space. Applying well-known set-theoretical consistency results we have shown that the sequence selection property and its weak version may be consistently distinguished. Finally, we applied the sequence selection property to answer two questions about sequential closure in functional space ${}^{X}\mathbb{R}$ posed by T. Orenshtein.

References

[BuSu13] Bukovský L. and Šupina J., *Modifications of sequence selection principles*, Topology Appl. **160** (2013), 2356–2370.

[Su13] Šupina J., *On sequence selection properties*, Filomat **27** (2013), 1523–1544.

[BuSu12] Bukovský L. and Šupina J., *Sequence selection principles for quasi-normal convergence*, Topology Appl. **159** (2012), 283–289.

Integration theory

An interesting project outside of my standard math interests. This is the cooperation of the whole Department of Mathematical Analysis at home university in a field of its former head.

In [HHKS], we performed a deep analysis of a concept of super level measures of a Borel measutable functions introduced by Y. Do and C. Thiele for the needs of interpolation and sampling of time-frequency operators using Carleson measures and convergence properties of sequences of integrals. We have shown that the original restriction to special topological spaces as well as to subadditive measures are not necessary, and represent a technical limitation. We described an algorithm for calculating super level measures in finite spaces in [BHS].

References

[HHKS] Halčinová L., Hutník O., Kiseľák J. and Šupina J., *Beyond the scope of super level measures*, Fuzzy Sets and Systems **364** (2019), 36–63.

[BHS] Borzová J., Halčinová L. and Šupina J., *Size-based super level measures on discrete space*, in: 17th International Conference, IPMU 2018, Commun. Comput. Inf. Sci. **853** (2018), 219–230.

Others

The category contains papers with yet small impact. [Su10] is my first paper with small analysis performed during the first year of my phd studies. In [Su15], I modified a property of a topological space introduced by H. Ohta and M. Sakai. In addition to their motivation that the so called Scheepers Conjecture is valid in such spaces, my property is the weakest one of such type. [Su14] is the continuation of its studies. In [SuUh] we have shown that an extension of two Lindenbaum composition theorems from Polish space to perfectly normal space is true and the research was performed in the frame of master thesis of D. Uhrik under my supervision. Finally, in [DSS], we study some ideal generalizations of a convergence of a sequence of real valued functions, and the results were obtained mainly during stay of P. Das in Košice.

Finally, although [StSu] has larger impact, my contribution was minor. Large team led by a strong researcher in economics. I prepared some particular parts

related to discontinuous functions.

References

[DSS] Das P., Sengupta S. and Šupina J., *$\mathcal{I}^{\mathcal{K}}$-convergence of sequences of functions*, Math. Slovaca **69** (2019), 1137–1148.

[SuUh] Šupina J. and Uhrik D., *On a Lindenbaum composition theorem*, Tatra Mt. Math. Publ. **74** (2019), 145–158.

[StSu] Stehlík M., Helperstorfer Ch., Hermann P., Šupina J., Grilo L.M., Maidana J.P., Fuders F. and Stehlíková S., *Financial and risk modelling with semicontinuous covariances*, Inform. Sci. **394-395** (2017), 246–272.

[Su15] Šupina J., *On Ohta-Sakai's properties of a topological space*, Topology Appl. **190** (2015), 119–134.

[Su14] Šupina J., *Notes on modifications of a* wQN*-space*, Tatra Mt. Math. Publ. **58** (2014), 129–136.

[Su10] Šupina J., wQN *spaces and related notions*, Tatra Mt. Math. Publ. **46** (2010), 71–77.

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