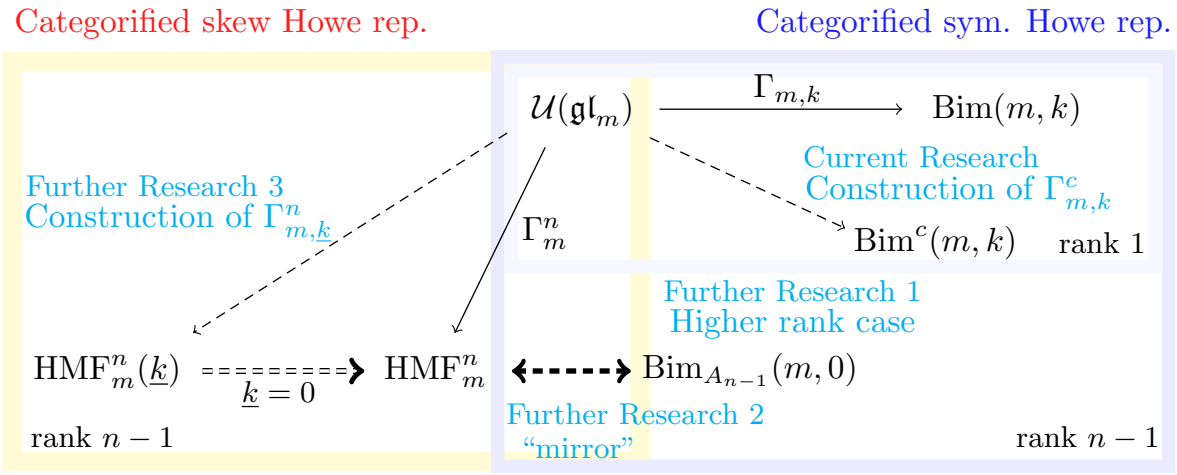

Solid arrows in the figure were results obtained in previous works of the applicant. Dashed arrows indicate future areas of study of the applicant.

The applicant defined a general type deformed Webster algebra $W^{\mathfrak{g}}$ as a subalgebra of the Khovanov-Lauda-Rouquier algebra. Ref: arXiv:2203.15964. Since the Khovanov-Lauda-Rouquier algebra has a p-DG structure, the p-DG structure is naturally considered for the algebra $W^{\mathfrak{g}}$. From now on, based on the algebra $W^{\mathfrak{g}}$, he will work on the construction of homological link invariants which refine the quantum invariants of links obtained from quantum groups $U_q(\mathfrak{g})$ and their representations, and also work on the construction of homological invariants of 3-dimensional manifolds.

Specifically, the applicant will work on the following.

Research Plan

(1) On the symmetric product $S^k(\mathbb{C}^n \otimes \mathbb{C}^m)$, we have a left $U_q(\mathfrak{sl}_n)$ action and a right $U_q(\mathfrak{gl}_m)$ action such that these actions commute. So, we have the representation

$$\gamma_m^{\mathfrak{sl}_n} : U_q(\mathfrak{gl}_m) \to \bigoplus_{\sum_{\alpha=1}^m i_\alpha = k, \sum_{\alpha=1}^m j_\alpha = k} \mathrm{Hom}_{U_q(\mathfrak{sl}_n)}(S^{i_1} \otimes \cdots \otimes S^{i_m}, S^{j_1} \otimes \cdots \otimes S^{j_m}).$$

It is expected that there exists a categorification of this representation on a bimodule category of the deformed Webster algebra $W^{A_{n-1}}$. The applicant will work on a categorification of quantum link invariants of type A.

(2) Using a p-DG structure in Khovanov-Lauda-Rouquier algebras and some algebras introduced by Khovanano and Qi, the applicant expects to be able to construct a categorification of representation theory in the case that the deformation parameter of algebras is a root of unity. And we can naturally introduce the p-DG structure on the algebra $W^{\mathfrak{g}}$ defined as a subalgebra of Khovanov-Lauda-Rouqier algebra since Khovanov-Lauda-Rouqier algebras have a p-DG structure. Using the p-DG structure, the applicant will work on a categorification of representations of quantum groups at roots of unity.

(3) The above (1) and (2) are studies on a categorification of structures appearing in symmetric tensor products. The applicant expects that a similar categorification can be constructed in the case of anti-symmetric tensor products. The applicant will work on the anti-symmetric case.